CALIFORNIA INSTITUTE OF TECHNOLOGY

EARTHQUAKE ENGINEERING RESEARCH LABORATORY

VELOCITY SPECTRA OF THE MEXICAN EARTHQUAKES OF 11 MAY AND 19 MAY 1962

by
Paul C. Jennings

Pasadena, California

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Abstract

Two earthquakes of approximate Magnitude 7.0 on the Richter scale occurred near Acapulco, Mexico in May, 1962. The acceleration records were recorded on two accelerographs in Mexico City, one in the foundation of the Tower Latino Americana and the second in Alameda Park. The velocity spectra of the eight components are presented here, along with details of the calculation method and the original acceleration records in both graphical and digital form.

Introduction

On 11 May 1962 a strong earthquake occurred south of Mexico City near Acapulco. The earthquake started at 14h-11m-52s Greenwich Civil Time and the California Institute of Technology Seismological Laboratory estimated the Magnitude as 7.0 on the Richter Scale. The United States Coast and Geodetic Survey estimated that the hypocenter depth was 25 kilometers and that the epicenter was located within a 30-kilometer radius of latitude 17.0N, longitude 99.7W. On 19 May 1962 at 14h-58m-13s GCT a second earthquake of Magnitude 7.0-7.25 occurred with a hypocenter depth of 20 kilometers and approximate epicenter location of latitude 17.2N, longitude 99.5W. Both of these earthquakes were felt strongly in Mexico City, approximately 260 kilometers to the north.

The accelerations of both earthquakes were recorded on two accelerographs in Mexico City, one located in the foundation of the Tower Latino Americana and the other in Alameda Park, about three blocks away as shown in Fig. 1. The Tower Latino Americana accelerograph is operated under the supervision of Dr. Leonardo Zeevaert and the Alameda Park instrument is operated by the Institute of Engineering of the University of Mexico under the supervision of Dr. Emilio Rosenblueth. Both accelerographs are SMAC recorders manufactured by the Akashi Seisakusho Company of Japan and some of the properties of the instruments are summarized in Table I. A SMAC recorder is shown in Fig. 2. A complete discussion of this and other types of accelerographs can be found in reference 1.

The 43-story Tower Latino Americana has been the object of extensive investigation including references 2, 3, 4, 5, 6 and 13, and its structural properties are well known. The period of the first mode has been computed to be 3.6 seconds, and the measured period of the second mode is approximately 1.6 seconds. References to particular aspects of the Tower, such as the soil conditions, may be found in the reference list of these publications. This section of Mexico City is underlain by a very soft clay layer of approximately 100 ft depth.

Figures 3, 4, 5 and 6 show tracings of the most significant portion of each of the acceleration records as recorded by the SMAC instruments. It should be noted that the actual acceleration trace is a much finer line than indicated in the figures. These records were digitalized by Dr. Zeevaert in the following manner: for each of the eight components a sixty-second interval which included the significant portion of the record was selected from the accelerogram; the vertical displacement of the acceleration trace with respect to the null line was then read at 0.10 second sub-intervals throughout the 60-second interval. The readings were made using a special magnifying viewer and the accuracy is $\pm$ 0.1 mm. The readings were taken from the original records for the Tower Latino Americana components and from photographic copies twice the size of the originals in the case of the Alameda Park records. Plots of these numbers to an exaggerated vertical scale were constructed by Dr. Zeevaert to show more clearly the characteristics of the acceleration records and these are shown in Figs. 7 and 8. The acceleration ordinates for each component were then sent to George W. Housner, Professor of Civil Engineering and Applied Mechanics, at the California Institute of Technology whereupon they were placed on punched cards

TABLE I.

Characteristics of the Tower Latino Americana and Alameda Park Accelerographs

	Alameda Park	Tower Latino Americana
Instrument type	SMAC-B	SMAC-D
Natural Period	0.10 sec.	0.14 sec.
Sensitivity	25 gals/mm	12.5 gals/mm
Damping	Critical	Critical
Recording Mechanism	Waxed Paper	Waxed Paper
Running Speed	10 mm/sec	10 mm/sec
Recording Range	10 - 1000 gal	6 - 500 gal
Recording Time Duration	3 min	3 min
Starter Sensitivity	10 gal	5 gal
Time Marking	1 sec.	1 sec.
Components	2 Horiz., 1 Vert.	2 Horiz., 1 Vert.
Orientation	N $10^{\circ}46'$W, N $79^{\circ}14'$E	N81°W, N9°E

and the calculations performed. The tabulated values of the acceleration ordinates are included in the Appendix.

From the acceleration components the well-known velocity spectra were calculated (7, 8, 10)*. The velocity spectrum S_v is defined herein as the maximum velocity (relative to the base) of a linear, viscously damped oscillator whose base is subjected to the earthquake acceleration as illustrated in Fig. 9. S_v is in general a function of the period and damping of the oscillator. Details of the calculations are presented in the next section.

Calculations

Consider a one degree of freedom spring-mass-dashpot structure as shown in Fig. 9 whose base is subjected to an earthquake. The equation of motion of this structure is

$$\ddot{x} + 2n\omega\dot{x} + \omega^2 x = -\ddot{y}(t) \tag{1}$$

where

x = the displacement of the mass relative to the base

n = the fraction of critical damping

ω = the natural frequency of the undamped oscillator

$\ddot{y}(t)$ = the acceleration of the ground

The solution of equation (1) is known(9) to be

$$x = \frac{-1}{\omega\sqrt{1-n^2}} \int_0^t \ddot{y}(\tau)\, e^{-\omega n(t-\tau)} \sin \omega\sqrt{1-n^2}\,(t-\tau)\, d\tau \tag{2}$$

*Numbers in parenthesis refer to references listed at the end of the report.

Differentiation yields the velocity

$$\dot{x} = -\int_0^t \ddot{y}(\tau)\, e^{-\omega n(t-\tau)} \cos \omega \sqrt{1-n^2}\,(t-\tau)\, d\tau$$

$$+ \frac{n}{\sqrt{1-n^2}} \int_0^t \ddot{y}(\tau)\, e^{-\omega n(t-\tau)} \sin \omega \sqrt{1-n^2}\,(t-\tau)\, d\tau \qquad (3)$$

We now define S_D as the maximum absolute value of equation (2), that is, the maximum relative displacement that occurs during the earthquake, and S_v as the maximum absolute value of equation (3) or equivalently, the maximum relative velocity that occurs during the earthquake. For a given earthquake it is seen that both S_D and S_v depend on n and ω. A plot of S_D against natural period for various damping values is called a displacement spectrum, and a similar plot with S_v is named the velocity spectrum. For small damping the second term in equation (3) becomes small with respect to the first and the following approximation has been found to hold[8],

$$S_v \approx \omega S_D \qquad (4)$$

where in addition to assuming $\sqrt{1 - n^2} \approx 1$ a sine has replaced the cosine in the first term of equation (3).

In the past the velocity spectra have been calculated both by finding S_v as defined here and by finding the maximum displacement and using formula (4). A discussion of the relative consistency of these two methods can be found in reference 10, where the reader is cautioned to use the definition of S_v given here and to disregard the author's equation (6) [11]. In this report the velocity spectra calculated represent the maximum relative velocity experienced by the oscillator, and formula (4) was not used. This is the more common way of calculating the velocity spectra as the maximum relative velocity is the quantity read on the Mark II Electric Analog Spectrum Analyzers operated by the California Institute of Technology and by the United States Coast and Geodetic Survey.

To perform the spectrum calculation equation (1) is first made dimensionless by letting

$$z = \frac{x\omega^2}{g} \tag{5}$$

and then

$$\tau = \omega t \tag{6}$$

under these transformations, equation (1) becomes

$$z'' + 2n\, z' + z = - \frac{\ddot{y}(\tau/\omega)}{g} \tag{7}$$

where g is the acceleration of gravity and the primes denote differentiation with respect to τ. The spectrum value S_v is transformed by these substitutions to

$$S_v = \frac{g}{\omega} \left| z' \right|_{max} \tag{8}$$

The integration of equation (7) was performed on an IBM 7090 digital computer at the California Institute of Technology Computing Center using a program written by the author. The integration scheme was a third-order Runge-Kutta method attributed to Heun, and is discussed in reference 12. The application of the method to equation (7) results in the following set of equations for the values of z and z' at the end of the $(r+1)^{st}$ integration step:

$$z_{r+1} = z_r + z'_r \, \Delta\tau + 1/2 \, K_1 \, \Delta\tau$$

$$z'_{r+1} = z'_r + 1/4 \, (K_o + 3K_2)$$

$$(9)$$

$$K_o = -\Delta\tau \left[\frac{1}{g} \ddot{y} \left(\frac{\tau r}{\omega} \right) + z_r + 2n \, z'_r \right]$$

$$K_1 = -\Delta\tau \left[\frac{1}{g} \ddot{y} \left(\frac{\tau r + 1/3 \, \Delta\tau}{\omega} \right) + (z_r + 1/3 \, z'_r \Delta\tau) + 2n \, (z'_r + 1/3 \, K_o) \right]$$

$$K_2 = -\Delta\tau \left[\frac{1}{g} \ddot{y} \left(\frac{\tau r + 2/3 \Delta\tau}{\omega} \right) + (z_r + 2/3 \, z'_r + 2/9 \, K_o \Delta\tau) + 2n \, (z'_r + 2/3 \, K_1) \right]$$

The oscillator starts from rest, so the initial conditions are

$$z_o = 0 \qquad (10)$$

$$z_o' = 0$$

To find S_v from equations (9) it was necessary to keep track of the largest value of z'_r that occurred during the earthquake and then to apply equation (8). At the end of the earthquake the kinetic and potential energies of the oscillator were determined in order to see if the maximum velocity up to that time would be exceeded in subsequent free vibration. This happened occasionally for the undamped oscillator, and in the cases where it did the spectrum point was calculated using the subsequent maximum. The resulting change in S_v in all cases was small, usually around 1 per cent.

The Runge-Kutta method was chosen because of its accuracy, long-range stability, self-starting feature, and because it can be adapted easily to cases where the earthquake is not defined at regular intervals. It has the disadvantage of being slower than other less flexible methods of comparable accuracy and stability.

As noted previously, the earthquake acceleration records were given at 0.10 second intervals for all components of the earthquakes. To reproduce a continuous record from the points supplied, the accelerogram was assumed to consist of straight lines between the given points.

It was felt that it would be desirable for the integration interval $\Delta\tau$ to be compatible with the interval between points on the accelerogram, and in particular $\Delta\tau$ should be chosen so that the corresponding $\Delta t = \Delta\tau/\omega$ would never exceed 0.10 second. To insure this, Δt was chosen as some fraction of 0.10

$$\Delta t = \frac{0.10}{K}$$

where K is an integer. Since $\Delta\tau = \omega\Delta t$ this means that

$$\Delta\tau = \frac{\omega}{10K} \tag{11}$$

With the integration steps chosen in this manner, the closest possible following of the acceleration record during the integration is obtained and the integer K represents the number of integration steps used to span the basic interval of the acceleration record. The integration steps must satisfy one other condition as the truncation error involved in using equations (9) is given by Hildebrand [12] as order of $(\Delta\tau)^4$. To insure that the error be small the additional requirement

$$\Delta\tau \leq 0.10 \tag{12}$$

was imposed. Using relations (11) and (12) the set of natural frequencies and integration steps shown in Table II was determined for use in the calculations. The natural periods to two decimal places and the values of K in equation (11) are also given.

To check the accuracy of the integration scheme, two checking procedures were performed. In the first $\ddot{y}(t)$ in equation (7) was replaced by $\cos \Omega t$ and the maximum velocity was compared with that of the exact solution for a few values of $\frac{\Omega}{\omega}$ and n. The purpose of this check was primarily to determine if any programming errors had been made. In the second check, one of the earthquake components was used and the size of the integration step was varied over a wide range to see if the chosen values of $\Delta\tau$ were small enough to give three-figure accuracy in the results. Examples of the results of this second check are shown in Table III. The times at which the maxima occur are also given, as a strict comparison between calculations of different step lengths is possible only when they indicate that the maxima occurred at the same time. It is apparent that increasing the integration step introduces two

TABLE II

Natural Frequencies and Integration Steps Used in the Spectrum Calculations

ω	$T = \frac{2\pi}{\omega}$	$\Delta\tau$	K
32.0	.20	0.10	32
25.0	.25	0.10	25
17.0	.37	0.10	17
12.5	.50	0.10416667	12
10.0	.63	0.10	10
8.50	.74	0.094444444	9
7.20	.87	0.09	8
6.250	1.01	0.089285714	7
5.60	1.12	0.093333333	6
5.00	1.26	0.10	5
4.60	1.37	0.092	5
4.20	1.50	0.084	5
4.08*	1.54	0.0816	5
3.86	1.63	0.0965	4
3.60	1.75	0.09	4
3.35	1.88	0.08375	4
3.150	1.99	0.07875	4
2.95	2.13	0.098333333	3
2.80	2.24	0.093333333	3
2.64	2.38	0.088	3
2.50	2.51	0.083333333	3
2.39	2.63	0.079666667	3
2.20	2.86	0.073333333	3
2.18	2.88	0.072666667	3
2.10	2.99	0.07	3
2.01	3.13	0.067	3
1.94	3.24	0.097	2
1.86	3.38	0.093	2
1.80	3.49	0.09	2
1.718**	3.66	0.0859	2
1.71	3.67	0.0855	2
1.68	3.74	0.084	2
1.62	3.88	0.081	2
1.58	3.98	0.079	2
1.52	4.13	0.076	2
1.48	4.25	0.074	2
1.44	4.36	0.072	2
1.40	4.49	0.07	2
1.36	4.62	0.068	2
1.32	4.76	0.066	2

**First natural frequency of the Tower Latino Americana (2)

*Second natural frequency of the Tower Latino Americana (2)

TABLE III

Examples of the Effect of Different Integration Steps on the Velocity Spectrum Values

	Velocity Spectrum Values for $\omega = 3.6$							
	n = 0.20		n = 0.10		n = 0.05		n = 0	
$\Delta\tau$	S_v	$t(S_v)$	S_v	$t(S_v)$	S_v	$t(S_v)$	S_v	$t(S_v)$
0.045	8.5268	30.450	11.047	16.337	15.829	24.187	44.821	27.600
0.06	8.5267	30.450	11.045	16.333	15.832	24.183	44.814	27.600
0.09*	8.5261	30.450	11.031	16.325	15.823	24.175	44.778	27.600
0.18	8.5207	30.450	11.021	16.350	15.752	24.200	44.428	27.600
0.36	8.3660	30.400	10.920	30.500	15.464	24.200	41.814	27.600

	Velocity Spectrum Values for $\omega = 1.32$							
	n = 0.20		n = 0.10		n = 0.05		n = 0	
$\Delta\tau$	S_v	$t(S_v)$	S_v	$t(S_v)$	S_v	$t(S_v)$	S_v	$t(S_v)$
0.011	9.3961	19.950	9.7505	19.983	9.6314	18.792	10.433	50.541
0.022	9.3960	19.950	9.7505	19.983	9.6301	18.783	10.431	50.550
0.044	9.3840	19.933	9.7419	20.000	9.6269	18.800	10.428	50.533
0.066*	9.3957	19.950	9.7418	20.000	9.6267	18.800	10.430	50.550
0.132	9.2715	19.900	9.7412	20.000	9.6258	18.800	10.385	50.500

* The value used in the spectrum calculations.

$t(S_v)$ is the time at which the maximum occurred.

The earthquake used was the N81°W component of the Tower Latino Americana record of 19 May 1962.

types of errors: the first being that the integration becomes less accurate; the second that the error involved in assuming that the maximum does not occur in the middle of an integration step becomes larger. Considering both types of errors, however, it is still clear that the value of $\Delta\tau$ used in the calculation gives results good to about four significant figures when compared to the smallest interval used. Furthermore, it appears possible that three-figure accuracy could be retained using integration steps twice as large as were used. Since the calculation of a velocity spectrum defined at 40 different frequencies and 4 values of damping takes 15 to 20 minutes on the relatively fast IBM 7090 (clear and add time 4.36 μs) the sacrifice of the fourth significant figure for the sake of speed may be justified in many instances.

Results

A velocity spectrum was made for each of the eight earthquake components. The spectrum consists of plots of maximum relative velocity S_v against natural period for damping values of n = 0, 0.05, 0.10 and 0.20. The S_v values for the forty different periods shown in Table II were used to define each curve; these points were then joined by straight lines. The spectra are shown in Figs. 10 to 17.

For any given period the usual order of S_v values for various damping is $S_v(0) > S_v(0.05) > S_v(0.10) > S(0.20)$. Occasionally, however, the spectrum lines cross. The values for $\omega = 1.32$ in Table III show an instance where $S_v(0) > S_v(0.10) > S_v(0.05) > S_v(0.20)$. No practical significance is attached to the fact that the spectrum lines cross, as in all cases the amount of overlap is so small that the curves appear to be tangent when the spectrum is plotted. Nevertheless, it is a curious fact that for particular earthquake components and certain natural frequencies an increase in damping in a particular range results in a small increase in S_v.

Acknowledgments

The author is grateful to Professor George W. Housner for his many helpful suggestions in the preparation of this report. The co-operation of Dr. Leonardo Zeevaert of Mexico City and Professor Donald E. Hudson of the California Institute of Technology is appreciated also.

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17. Velocity Spectrum for the Alameda Park 19 May 1962
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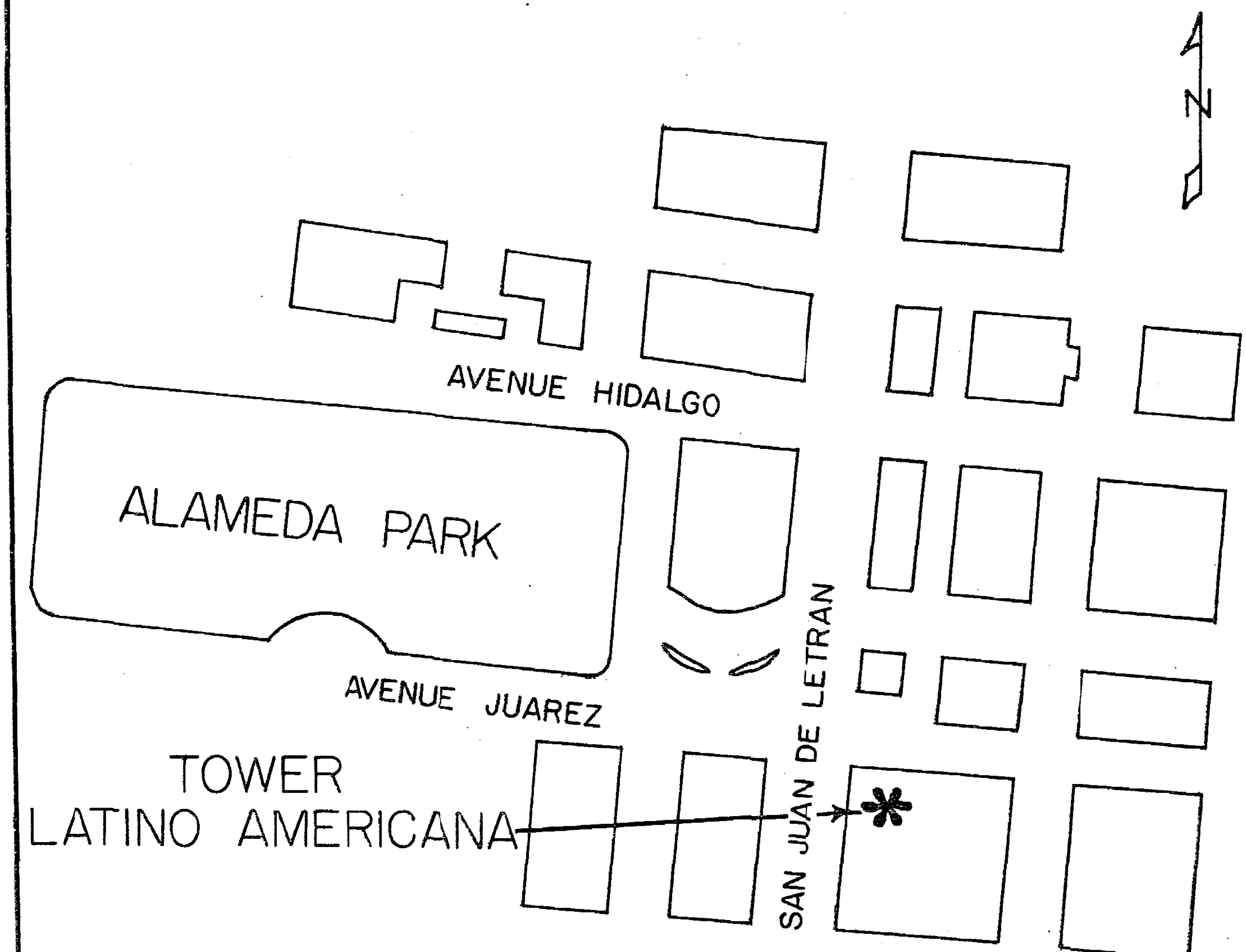


Figure 1
A Section of Central Mexico City

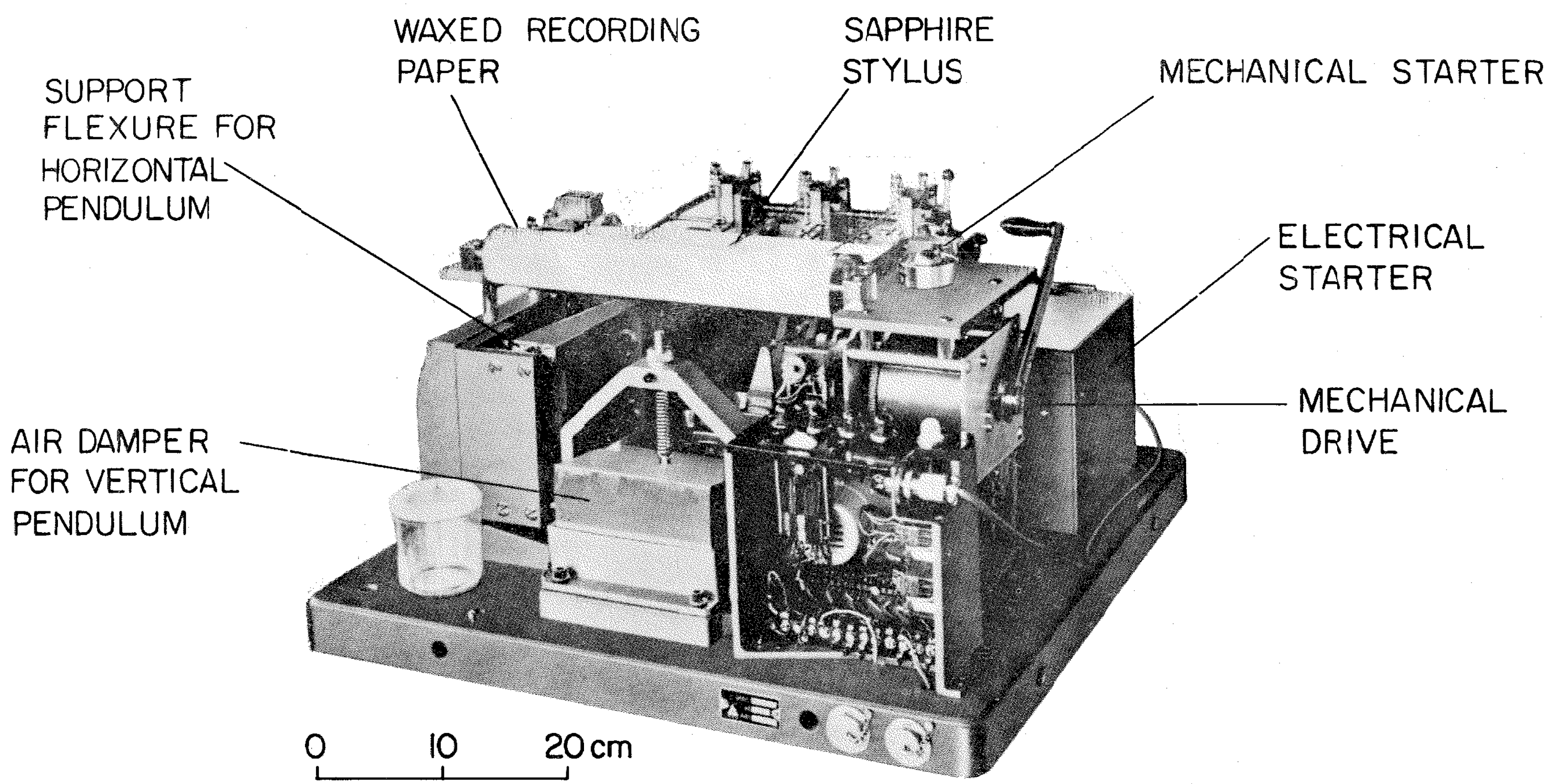


Figure 2
The SMAC Strong-Motion Seismograph

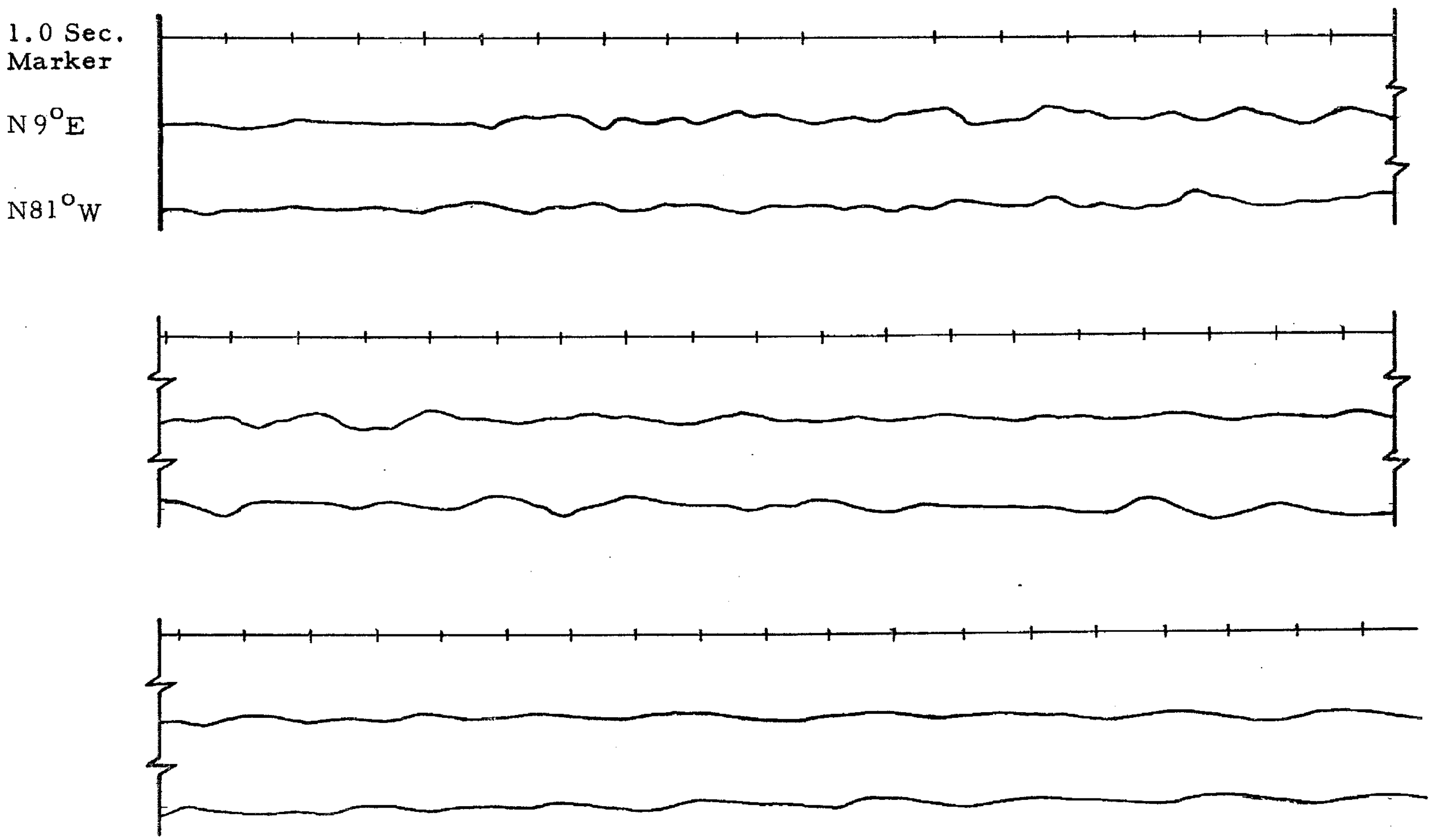


Figure 3
Major Portion of Accelerogram
Tower Latino Americana, 11 May 1962
From a Photographic Reproduction of the Original Record

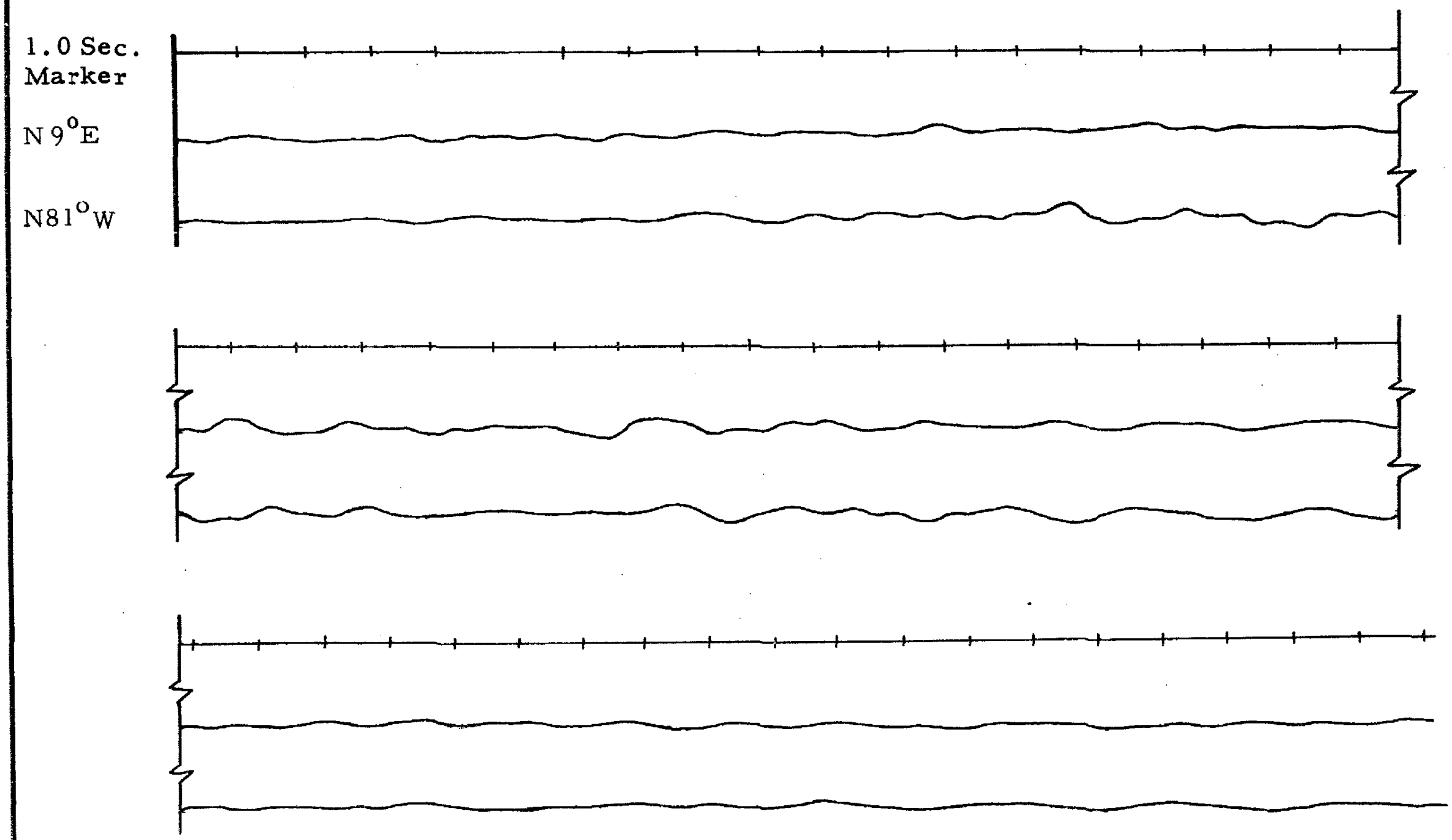


Figure 4
Major Portion of Accelerogram
Tower Latino Americana, 19 May 1962
From a Photographic Reproduction of the Original Record

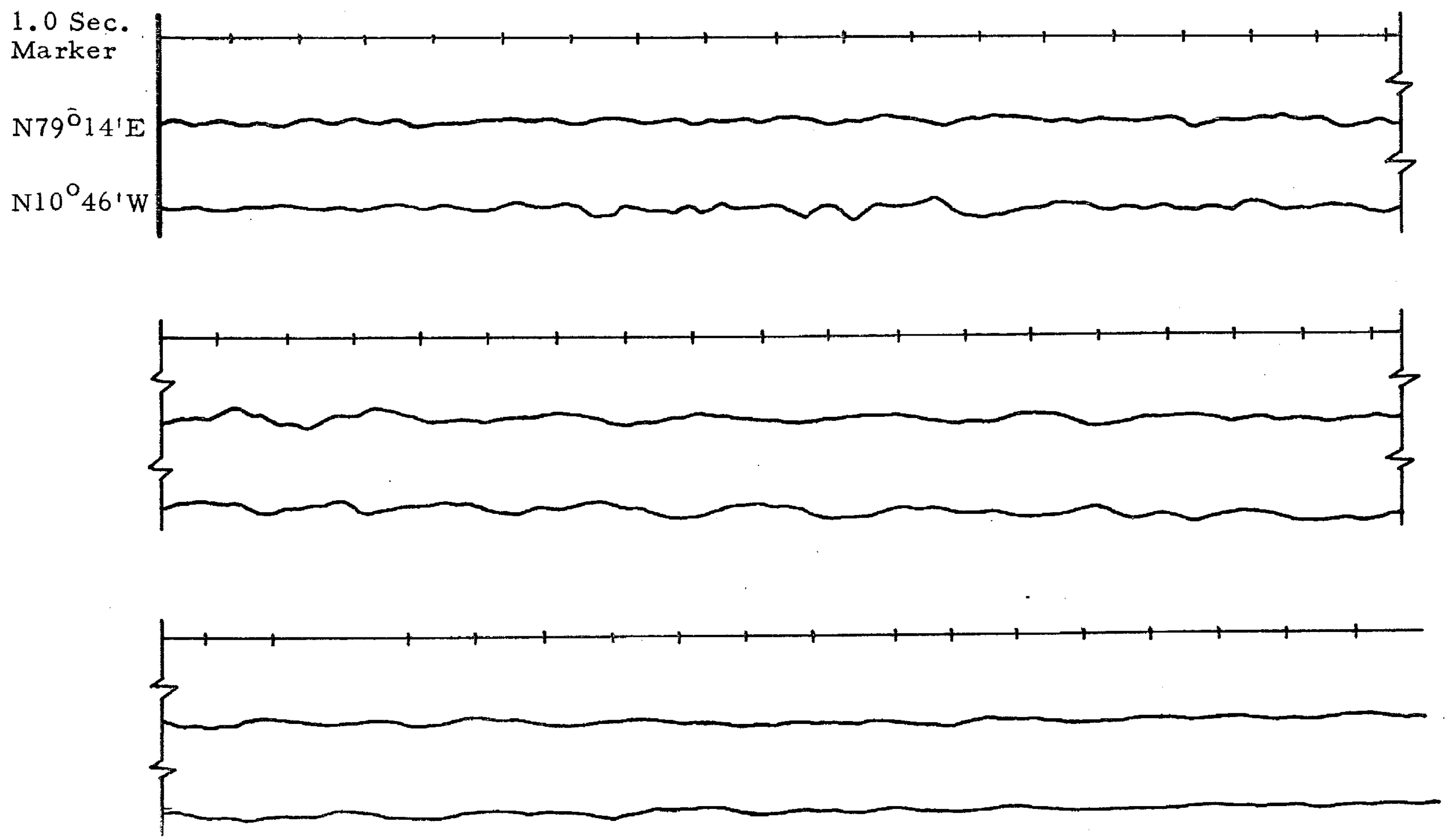


Figure 5

Major Portion of Accelerogram
Alameda Park, 11 May 1962
From a Photographic Reproduction of the Original Record

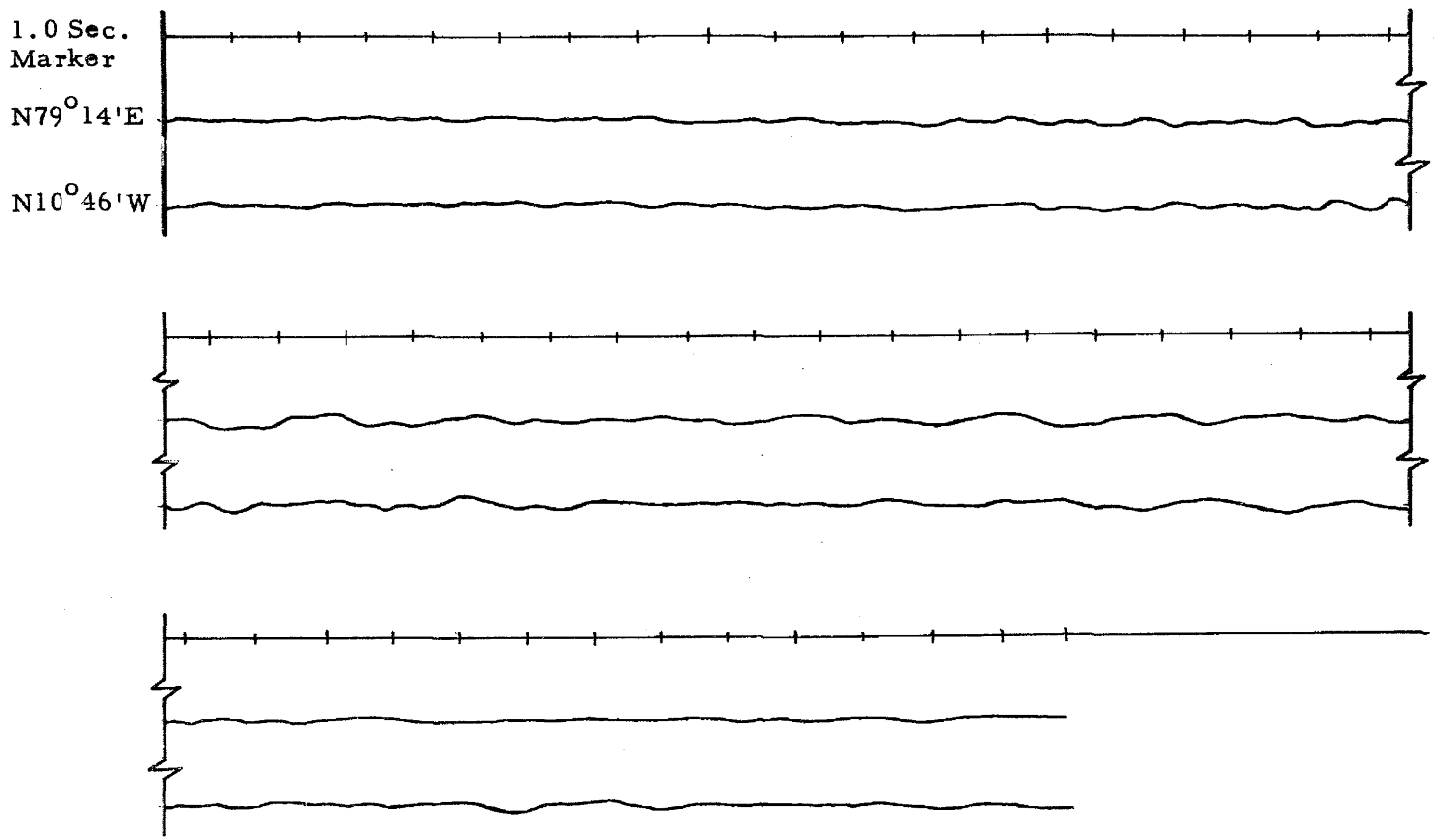


Figure 6
Major Portion of Accelerogram
Alameda Park, 19 May 1962
From a Photographic Reproduction of the Original Record

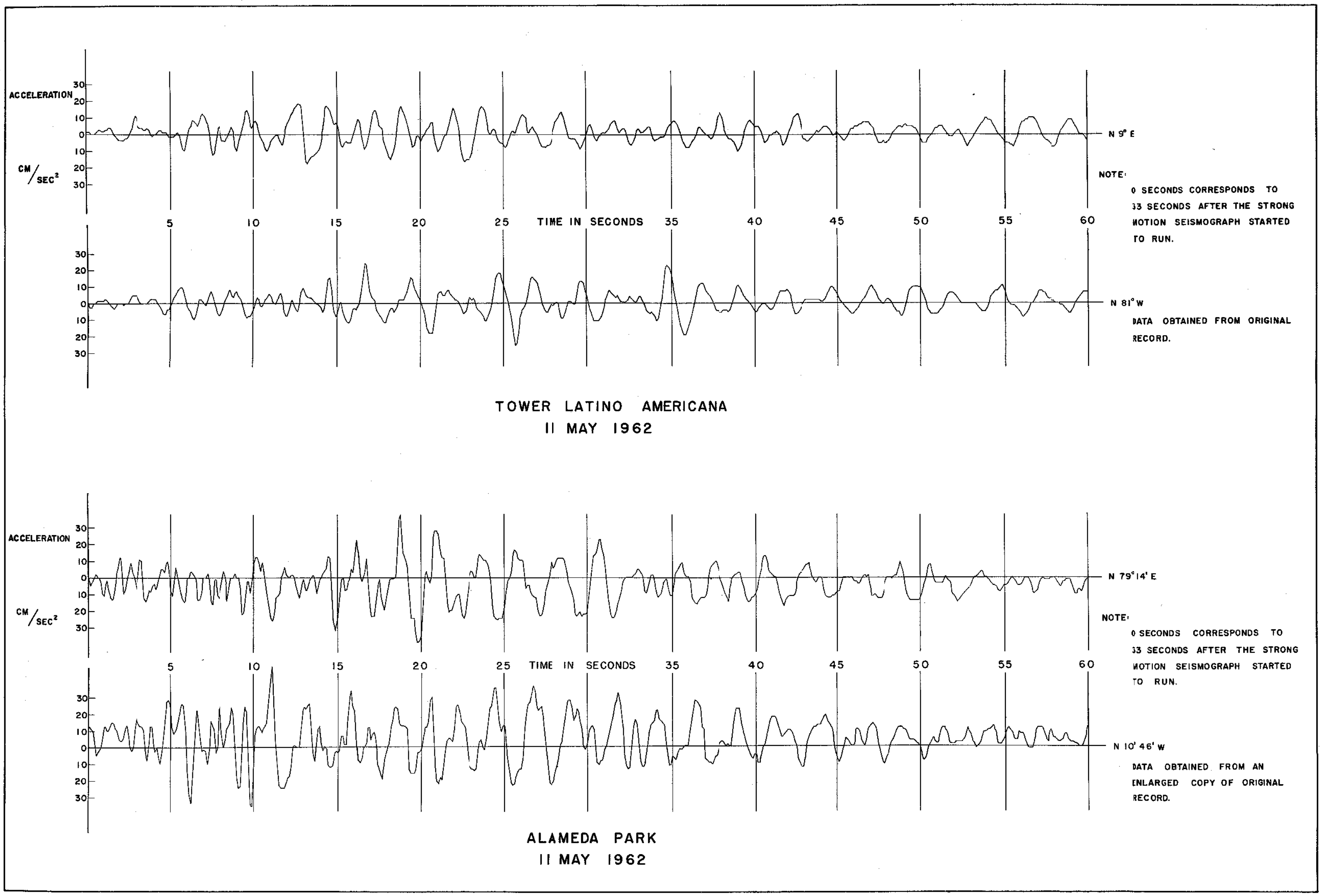


Figure 7

Acceleration Records for the Earthquake of 11 May 1962

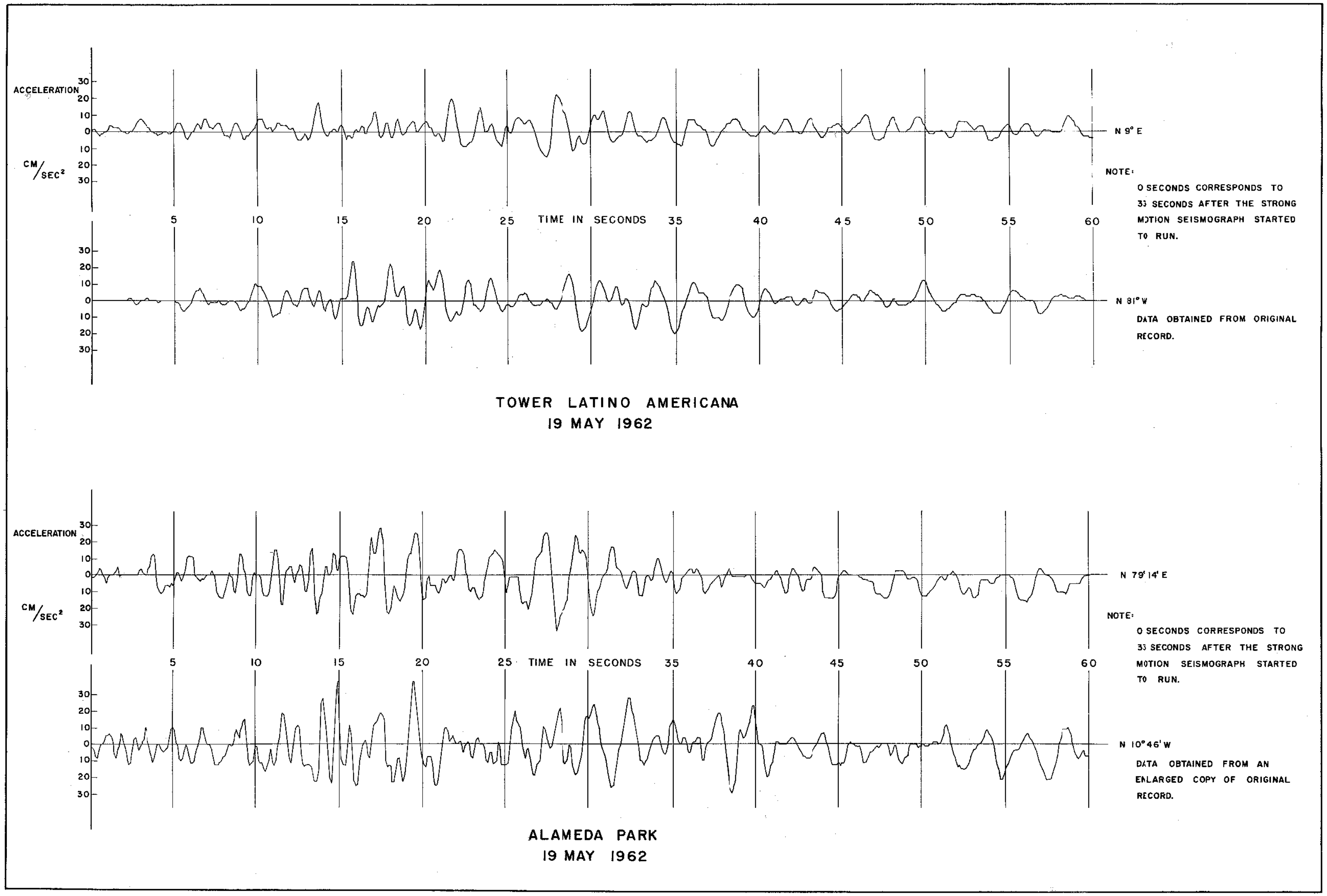


Figure 8
Acceleration Records for the Earthquake of 19 May 1962

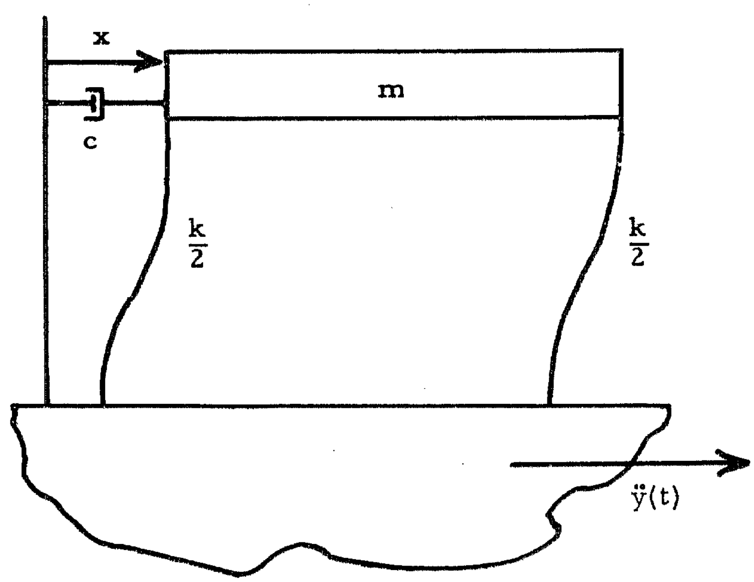


Figure 9

A One Degree of Freedom Linear Oscillator

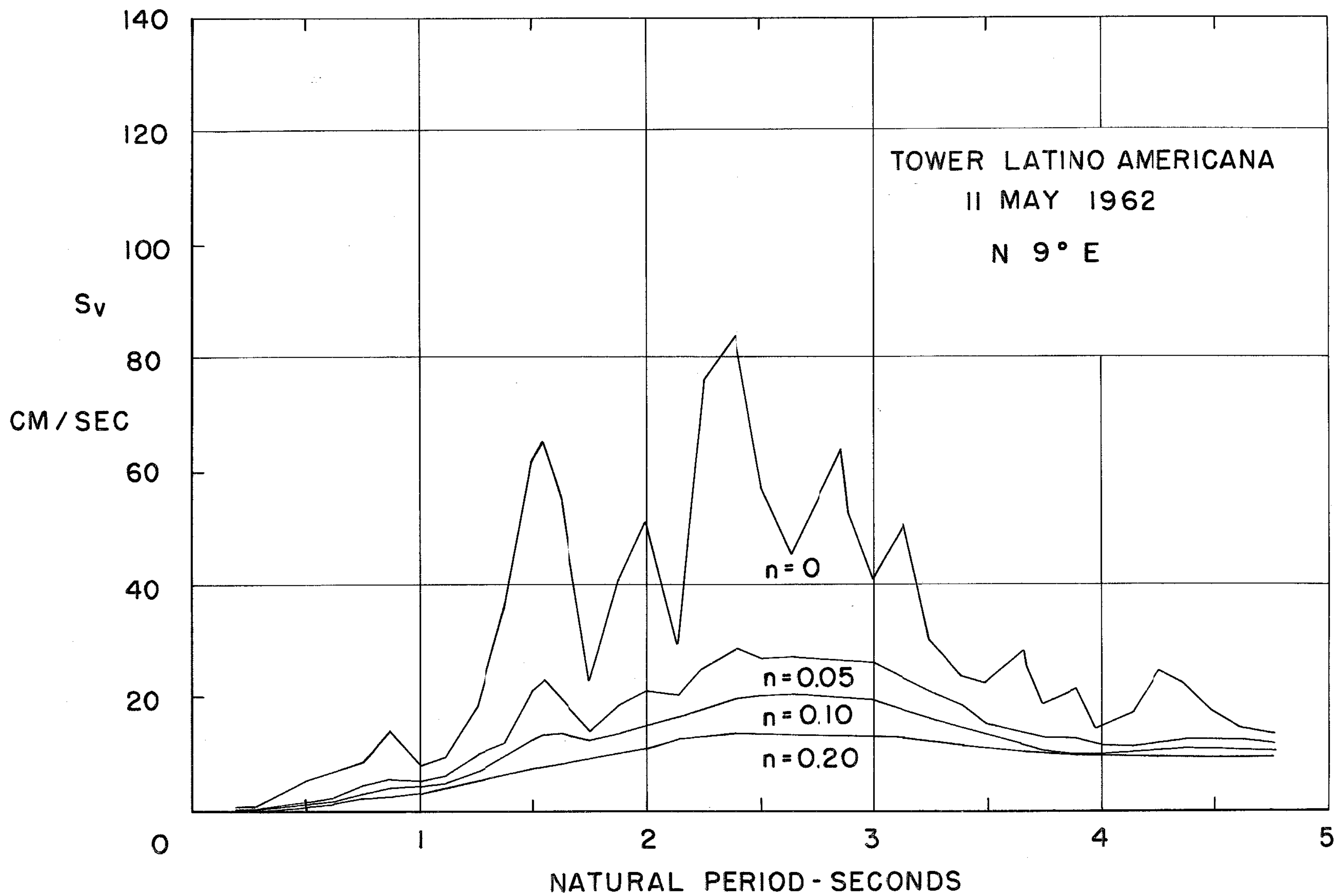


Figure 10

Velocity Spectrum for the Tower Latino Americana 11 May 1962 N9^{O}E Component

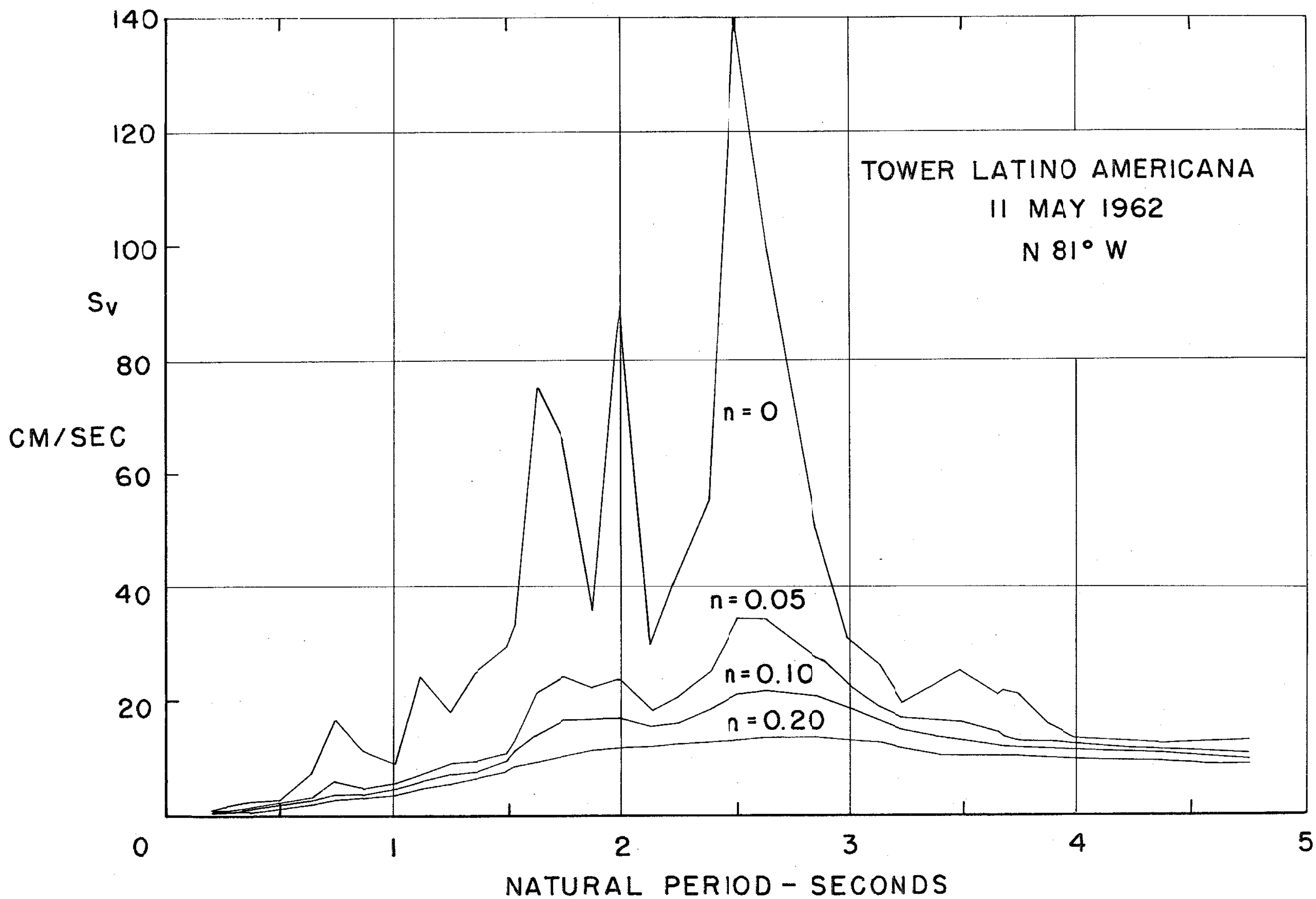


Figure 11

Velocity Spectrum for the Tower Latino Americana 11 May 1962 N81^{o}W Component

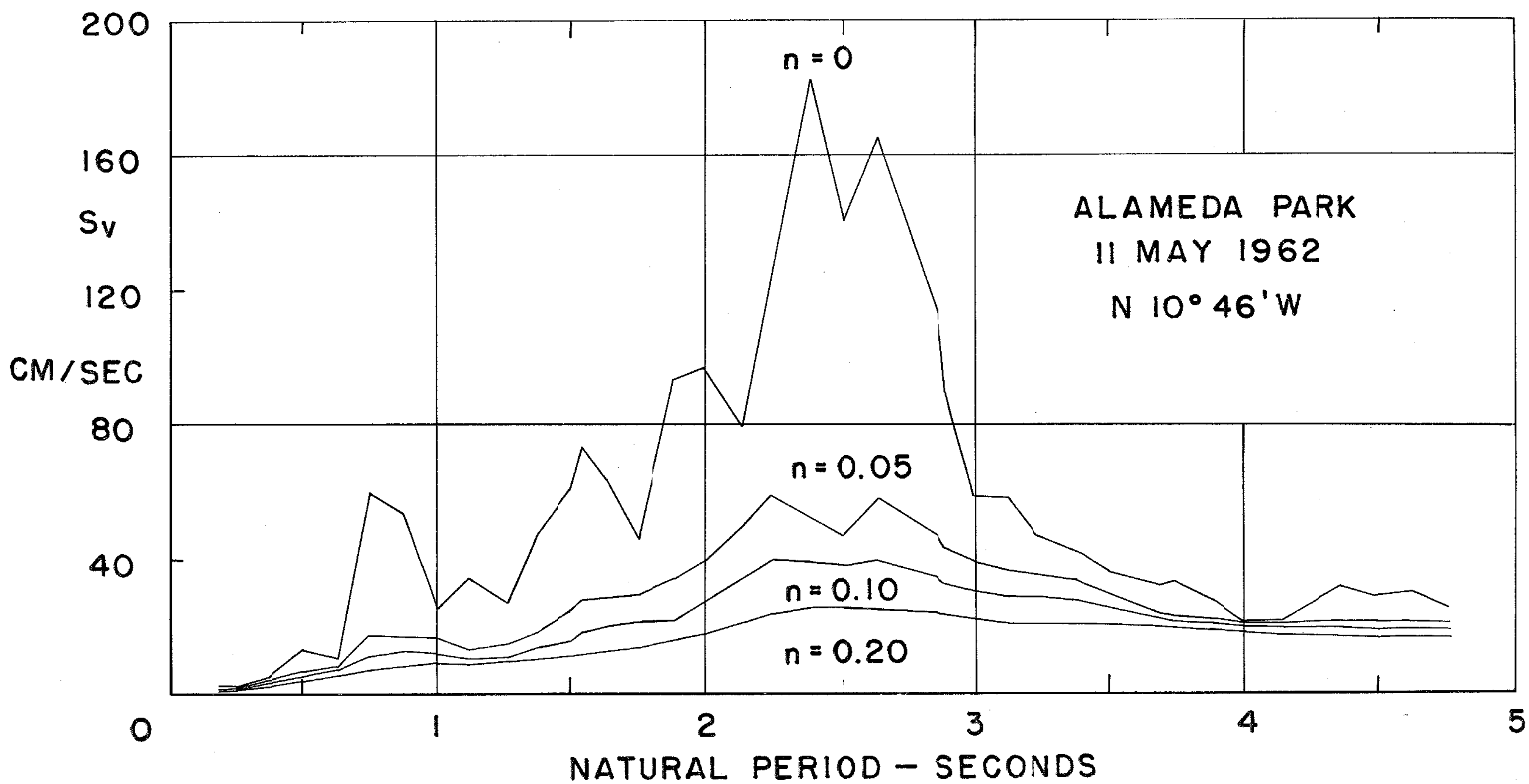


Figure 12

Velocity Spectrum for the Alameda Park 11 May 1962 N 10°46'W Component

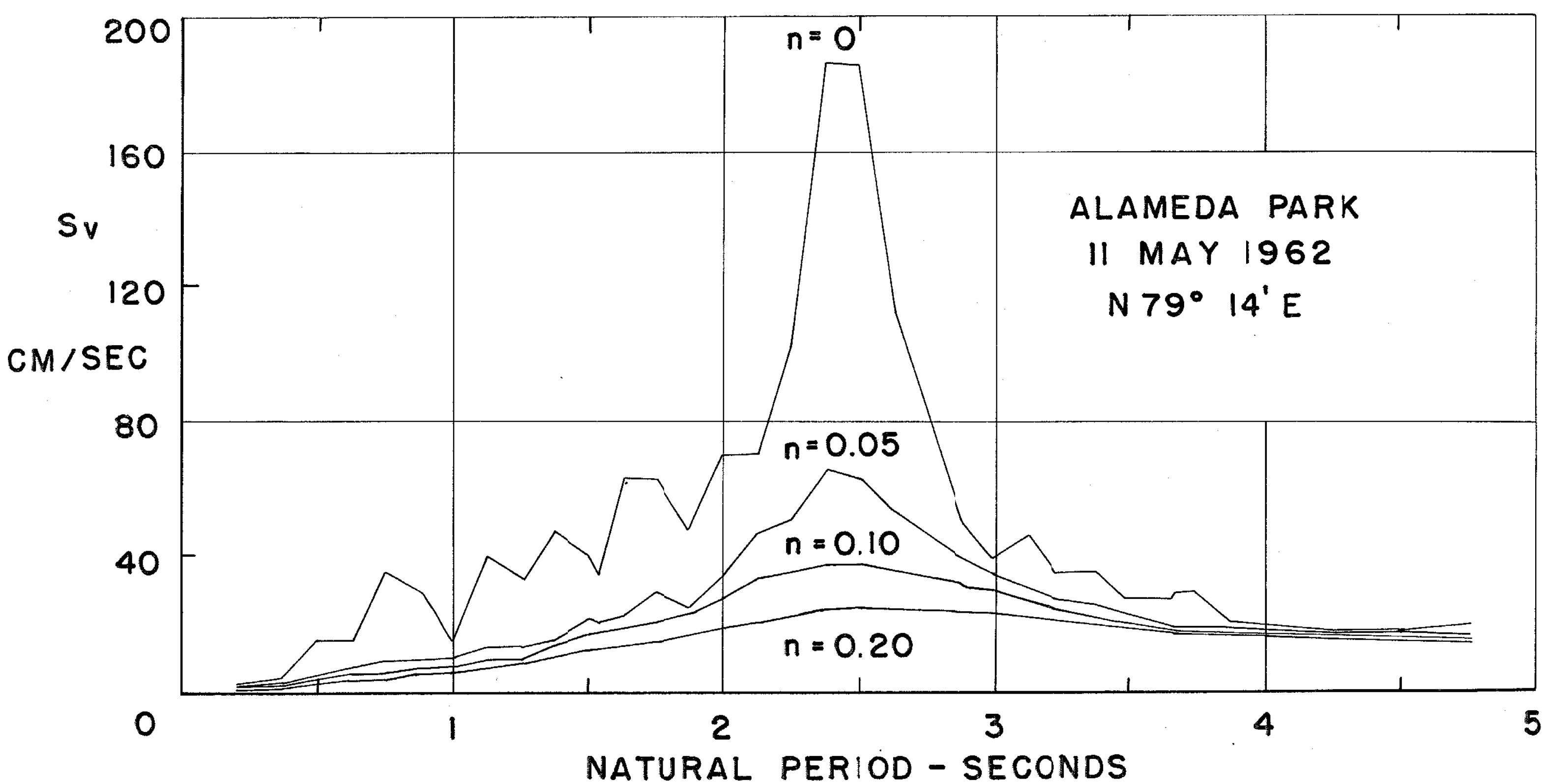


Figure 13

Velocity Spectrum for the Alameda Park 11 May 1962 N79°14'E Component

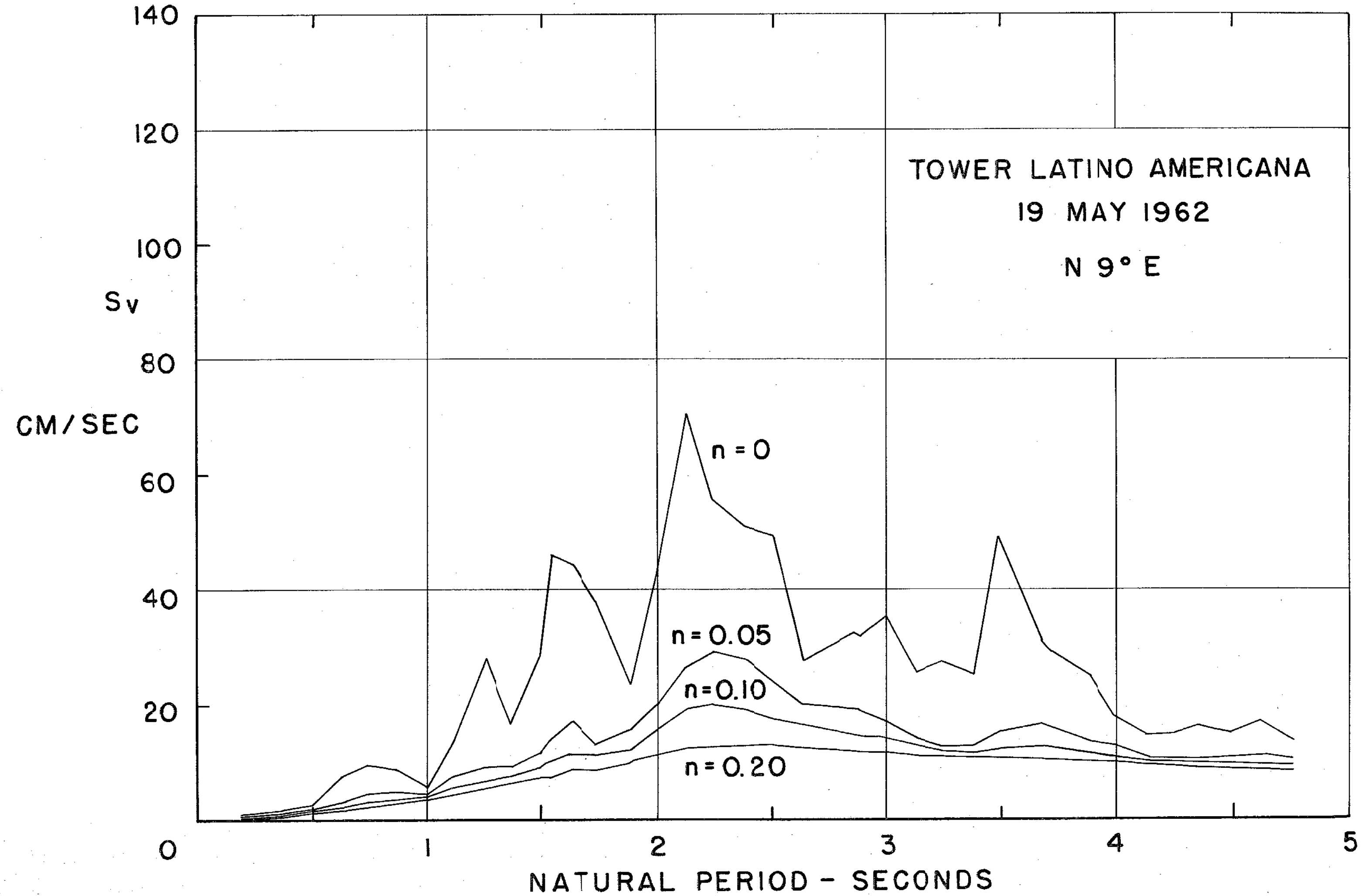


Figure 14

Velocity Spectrum for the Tower Latino Americana 19 May 1962 N9°E Component

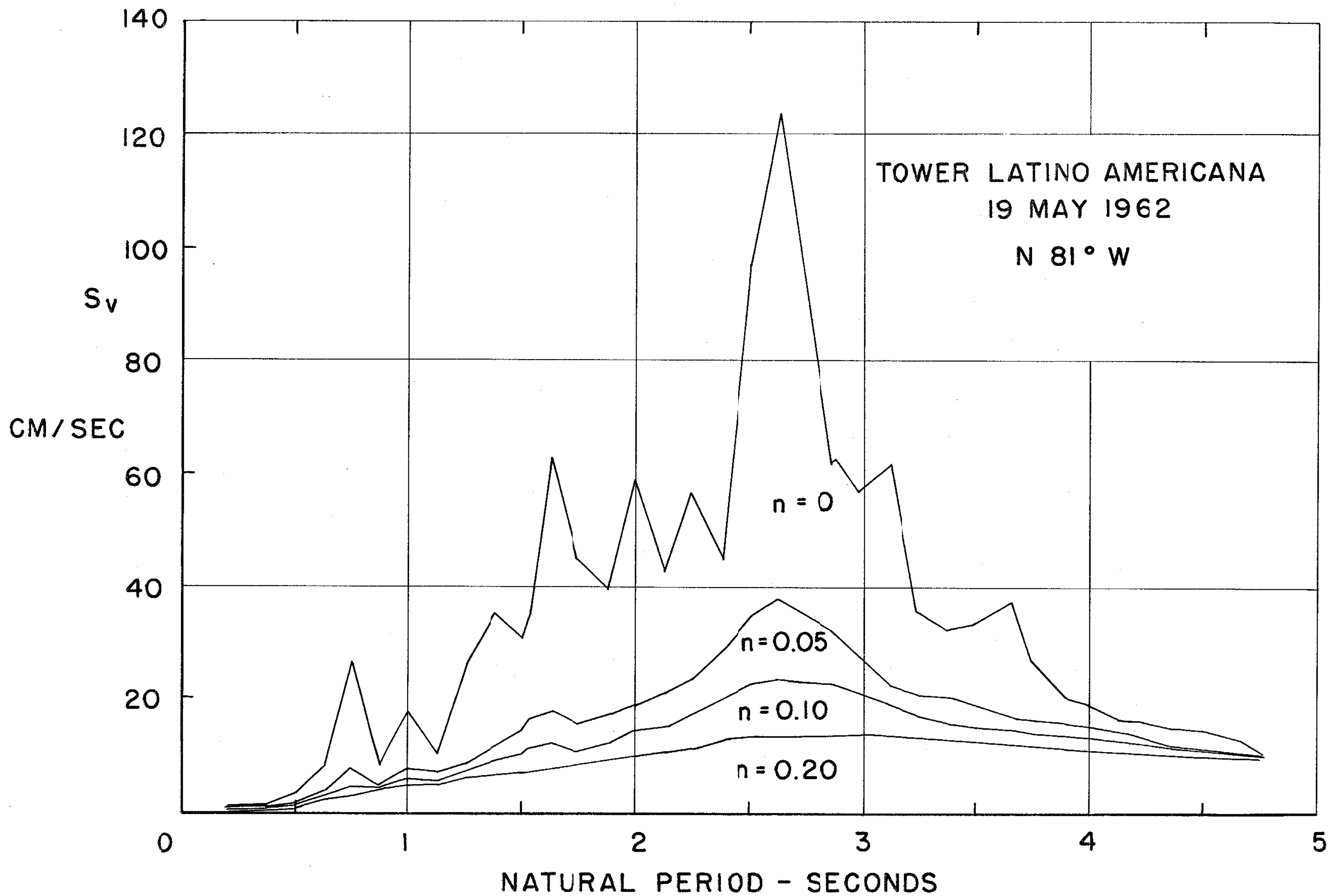
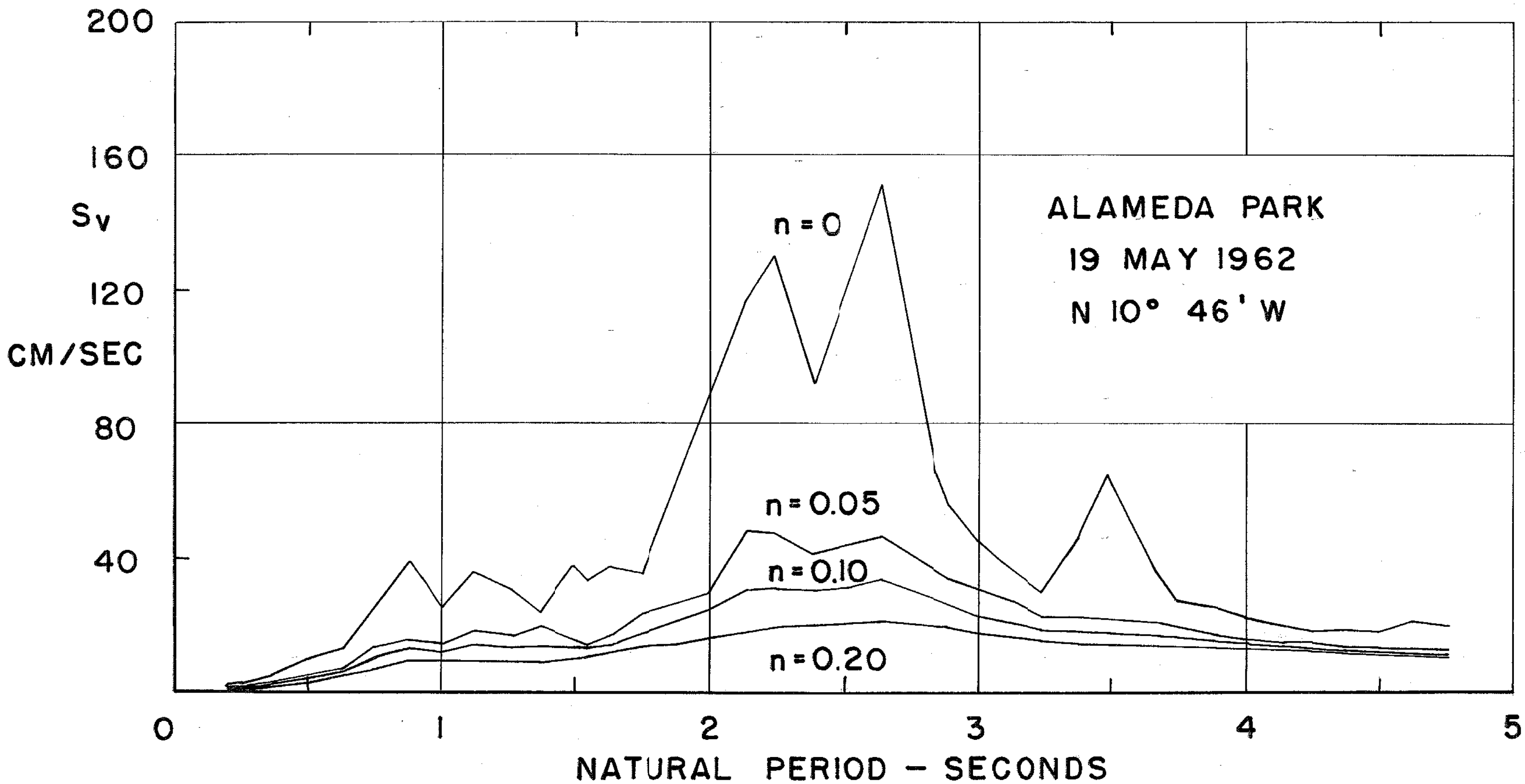


Figure 15

Velocity Spectrum for the Tower Latino Americana 19 May 1962 N81°W Component



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Velocity Spectrum for the Alameda Park 19 May 1962 N10°46'W Component

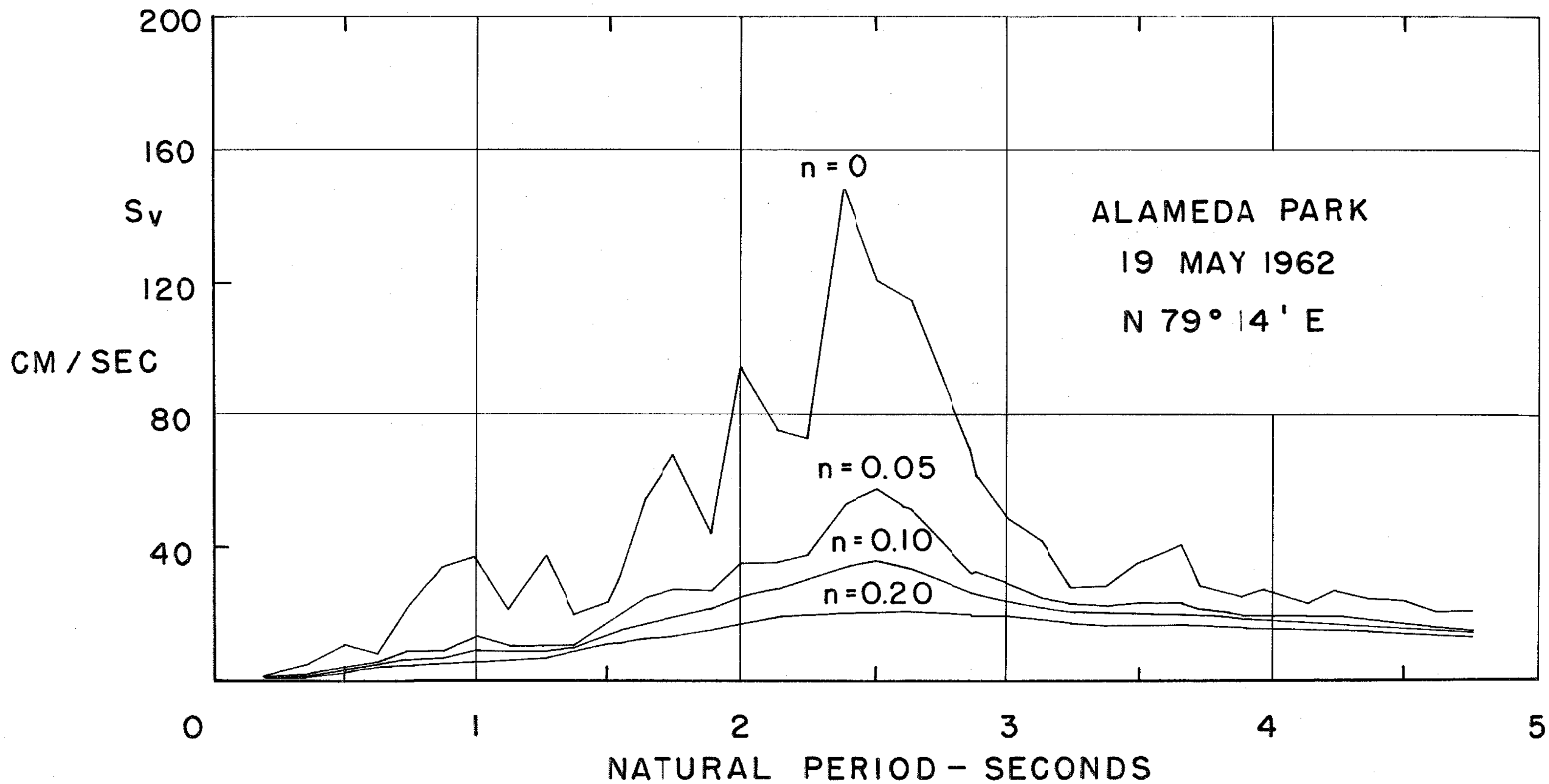

Figure 17

Velocity Spectrum for the Alameda Park 19 May 1962 N79°14'E Component

Appendix

Acceleration Ordinates of the Mexican Earthquakes of 11 May and 19 May 1962

The numbers in the following tables are the acceleration ordinates in millimeters. When read from left to right, the numbers represent the value of the ordinate at 0.10 second intervals. There are 601 numbers in each table; the first number is the ordinate at $t = 0$ seconds and the last number the ordinate at $t = 60$ seconds.

The instrument location, the date of the earthquake, the orientation of the component and the instrument sensitivity are listed in the headings of each table.

TOWER LATINO AMERICANA RECORD OF 11 MAY 1962

N 9°E COMPONENT. INSTRUMENT SENSITIVITY 12.5 gal/mm

.0	.1	.1	.0	.0	.0	.1	.2	.2	.1
.1	.2	.2	.3	.3	.2	.0	-.1	-.2	-.3
-.3	-.3	-.3	-.2	-.2	-.1	.1	.3	.7	.9
.8	.4	.3	.3	.3	.2	.2	.3	.2	.0
-.1	.0	.0	.1	.2	.2	.1	.1	.1	.0
-.1	-.1	-.1	-.1	.0	.1	.0	-.4	-.7	-.8
-.5	.0	.3	.4	.7	.6	.5	.4	.6	.9
1.0	.9	.7	.5	.1	-.6	-1.0	-.9	-.3	.3
.4	.2	-.3	-.3	-.3	-.2	.0	.2	.4	.1
-.6	-.8	-.5	-.1	.2	.5	1.1	1.2	.9	.4
.3	.6	.7	.5	.1	-.1	-.3	-.4	-.7	-.8
-.6	-.3	-.2	-.1	.0	.0	-.2	-.4	-.5	-.1
.4	.6	.8	1.0	1.1	1.3	1.4	1.5	1.5	1.2
.4	-.5	-1.3	-1.4	-1.2	-1.1	-1.0	-1.0	-.9	-.8
-.7	-.4	.4	1.3	1.4	1.3	1.2	1.0	.6	.5
.6	.4	-.1	-.5	-.6	-.4	-.3	-.4	-.4	-.4
-.1	.2	.5	.8	.5	-.1	-.4	-.7	-.6	-.4
.1	.5	1.0	1.2	1.2	.8	.5	.4	.3	-.3
-.6	-.8	-1.1	-1.2	-1.0	-.8	-.4	.3	1.1	1.4
1.2	1.0	.8	.5	.2	-.2	-.6	-.5	-.1	.0
-.1	-.3	-.1	.0	.2	.3	.4	.6	.6	-.1
-.6	-.8	-.7	-.5	-.2	.0	.0	.3	.7	1.1
1.3	1.1	.8	.4	-.2	-.8	-1.2	-1.3	-1.2	-1.2
-1.2	-1.1	-.8	-.4	.1	.6	1.0	1.3	1.4	1.3
1.1	.6	.1	.0	.2	.3	.2	-.1	-.3	-.4
-.4	-.5	-.6	-.5	-.2	.1	.2	.1	.1	.4
.6	.9	1.0	.9	.4	.1	.1	.3	.4	.2
.1	.0	-.3	-.5	-.6	-.6	-.6	-.5	-.5	-.4
-.1	.3	.6	.7	.8	1.0	1.1	.9	.5	.2
-.1	-.2	-.2	-.2	-.2	-.3	-.5	-.7	-.6	-.4
-.1	.1	.4	.5	.3	.0	-.2	-.3	-.1	.0
.1	.1	.1	.2	.3	.5	.6	.7	.6	.3
.1	.2	.3	.3	.1	-.2	-.4	-.5	-.4	-.2
.2	.3	.2	.1	.1	.2	.3	.4	.4	.1
-.2	-.3	-.2	-.2	-.1	-.1	-.1	.0	.2	.4
.5	.6	.7	.6	.5	.3	.0	-.3	-.4	-.6
-.6	-.6	-.5	-.3	-.2	.0	.3	.4	.3	.2
.1	.0	.0	-.1	-.2	-.1	.1	.4	.8	1.0
1.1	.9	.6	.2	.0	-.1	-.2	-.2	-.3	-.4
-.6	-.8	-.7	-.5	-.2	.2	.5	.6	.7	.6
.5	.4	.4	.4	.3	.1	-.2	-.4	-.3	-.2
.0	.0	.1	.1	.2	.1	.0	-.3	-.5	-.4
-.2	.1	.3	.5	.8	.9	1.0	1.0	.7	.3
.0	-.2	-.2	-.3	-.3	-.2	-.1	.0	.1	.2
.1	.2	.3	.4	.4	.4	.3	.2	.0	.0

TOWER LATINO AMERICANA RECORD OF 11 MAY 1962
N 9°E COMPONENT. INSTRUMENT SENSITIVITY 12.5 gal/mm (Continued)

.1	.1	.0	-.1	-.2	-.3	-.2	-.1	.1	.3
.3	.4	.4	.4	.5	.5	.6	.6	.6	.6
.5	.4	.3	.0	-.2	-.4	-.4	-.4	-.3	-.4
-.4	-.4	-.3	-.2	.0	.1	.2	.3	.4	.4
.3	.4	.5	.4	.4	.4	.4	.3	.3	.1
.0	-.2	-.4	-.4	-.4	-.2	-.1	.0	.1	.2
.3	.3	.4	.4	.4	.2	.1	.0	-.1	-.1
-.1	.0	.1	.2	.2	.0	-.1	-.3	-.5	-.6
-.4	-.3	-.2	.0	.1	.3	.4	.5	.6	.8
.8	.7	.7	.6	.4	.3	.1	.0	-.1	-.2
-.3	-.4	-.4	-.4	-.5	-.5	-.6	-.4	-.2	.1
.4	.6	.6	.7	.7	.8	.8	.8	.8	.7
.5	.3	.1	-.1	-.2	-.3	-.3	-.4	-.5	-.6
-.6	-.6	-.5	-.2	.0	.2	.3	.4	.5	.6
.7	.7	.6	.4	.3	.1	.0	.0	.0	-.1
-.3									

TOWER LATINO AMERICANA RECORD OF 11 MAY 1962
N81°W COMPONENT. INSTRUMENT SENSITIVITY 12.5 gal/mm

.0	-.2	-.2	.0	.0	.1	.1	.1	.1	.1
.2	.1	.0	-.1	-.2	-.3	-.2	.0	.0	.0
.0	-.1	.0	.0	.0	.2	.4	.4	.4	.4
.3	.1	.0	.0	.0	.0	.0	.1	.2	.2
.2	.2	.0	-.1	-.2	-.4	-.5	-.5	-.3	-.3
-.1	.1	.3	.4	.6	.7	.8	.8	.5	.2
-.1	-.3	-.4	-.7	-.8	-.6	-.2	.2	.2	.1
.0	-.1	.1	.4	.6	.4	.1	-.2	-.5	-.6
-.6	-.4	-.2	.1	.3	.5	.7	.4	.3	.5
.6	.4	.3	.1	-.2	-.5	-.7	-.6	-.6	-.5
-.2	.0	.3	.2	-.1	-.1	.0	.2	.3	.5
.4	.1	.0	.0	.2	.4	.5	.1	-.4	-.6
-.6	-.3	.1	.2	-.1	-.3	-.4	.0	.6	.8
.6	.4	.3	.3	.3	.2	.1	.0	.0	-.1
-.2	-.4	-.2	.6	1.2	1.3	.8	.1	-.4	-.6
-.4	.0	.1	-.3	-.6	-.8	-.9	-.9	-.7	-.3
-.2	-.3	-.1	.4	.9	1.5	2.0	1.9	1.2	.6
.4	.3	.2	-.2	-.4	-.5	-.6	-.8	-.9	-.9
-.6	-.4	-.2	-.2	-.4	-.3	-.1	.2	.2	.2

TOWER LATINO AMERICANA RECORD OF 11 MAY 1962

N81°W COMPONENT. INSTRUMENT SENSITIVITY 12.5 gals/mm (Continued)

.2	.4	.6	1.0	1.3	1.2	.8	.6	.4	.3
.1	-.1	-.3	-.7	-1.2	-1.4	-1.5	-1.4	-.7	.0
.5	.6	.6	.4	.4	.6	.7	.5	.4	.3
.2	.2	.1	.0	-.3	-.5	-.4	-.2	.2	.4
.3	.2	.3	.1	-.2	-.3	-.4	-.5	-.6	-.8
-.8	-.6	-.3	.1	.7	1.2	1.4	1.5	1.5	1.2
.9	.6	.3	.0	-.4	-.9	-1.5	-2.0	-1.9	-1.3
-.6	-.3	-.2	.0	.3	.8	1.2	1.3	1.2	1.1
1.0	.7	.3	.0	-.2	-.4	-.4	-.2	.0	-.1
-.1	.0	.1	.0	-.4	-.7	-.7	-.5	-.2	.1
.1	.1	.0	.0	.4	.9	1.1	1.1	1.0	.7
.4	.0	-.3	-.7	-.8	-.8	-.8	-.8	-.7	-.5
-.2	.2	.4	.7	.6	.5	.4	.3	.4	.2
.1	.1	.1	.1	.2	.4	.3	.2	.1	.1
.2	.4	.3	.1	-.1	-.3	-.4	-.5	-.4	-.5
-.6	-.8	-.7	-.3	.3	1.1	1.7	1.9	1.8	1.6
1.2	.7	.3	-.2	-.6	-1.0	-1.3	-1.5	-1.5	-1.3
-1.0	-.8	-.4	.0	.4	.8	.9	1.0	1.0	.6
.6	.5	.4	.3	.1	-.1	-.3	-.3	-.4	-.4
-.4	-.3	-.3	-.3	-.4	-.3	-.1	.2	.5	.8
.9	.8	.6	.4	.3	.2	.1	.0	-.1	-.3
-.4	-.4	-.2	-.1	.0	.0	.0	-.1	-.2	-.3
-.3	-.2	.0	.2	.4	.6	.6	.6	.6	.7
.6	.4	.0	-.3	-.5	-.5	-.4	-.3	-.1	.0
.1	.2	.2	.2	.2	.2	.2	.2	.2	.2
.1	.1	.2	.3	.5	.7	.8	.8	.7	.6
.4	.2	.1	.0	-.1	-.2	-.3	-.4	-.5	-.5
-.4	-.3	-.2	.0	.1	.2	.3	.5	.7	.8
.9	.7	.6	.4	.2	.1	.0	.0	.0	.1
.2	.2	.1	.0	-.2	-.3	-.4	-.4	-.6	-.6
-.4	-.1	.3	.6	.7	.8	.8	.8	.8	.8
.7	.5	.3	.0	-.3	-.4	-.5	-.5	-.5	-.5
-.5	-.4	-.3	-.2	.0	.2	.4	.5	.5	.5
.4	.3	.2	.1	.0	.0	.0	.0	.0	.0
.0	.0	.0	-.1	-.2	-.3	-.4	-.4	-.4	-.2
.0	.3	.4	.5	.6	.6	.7	.8	.9	.7
.4	.1	.0	-.1	-.1	-.1	-.2	-.3	-.4	-.6
-.7	-.6	-.5	-.4	-.2	.0	.0	.2	.3	.5
.6	.6	.5	.5	.3	.2	.2	.2	.1	.1
.0	.0	.0	-.1	-.1	-.2	-.3	-.4	-.5	-.5
-.4	-.2	.0	.1	.2	.3	.4	.5	.5	.5
.5									

TOWER LATINO AMERICANA RECORD OF 19 MAY 1962
N9°E COMPONENT. INSTRUMENT SENSITIVITY 12.5 gals/mm

.0	.1	.1	.0	-.1	-.2	-.1	-.1	.0	.0
.1	.3	.3	.2	.2	.2	.2	.1	.0	.0
.0	-.1	-.1	.0	.0	.1	.2	.4	.5	.6
.6	.5	.4	.3	.2	.2	.1	.0	.0	-.1
-.1	-.2	-.1	-.1	.0	.0	.0	-.1	-.1	.0
.0	.2	.4	.4	.4	.2	.0	-.3	-.4	-.3
-.1	.0	.0	.2	.4	.3	.1	.3	.6	.6
.4	.2	.2	.1	.2	.3	.4	.4	.2	.0
-.2	-.2	-.2	-.3	-.4	-.1	.2	.4	.4	.3
.1	-.1	-.4	-.4	-.2	-.2	-.1	.0	.1	.2
.4	.6	.6	.6	.4	.2	.1	.2	.2	.0
.1	.2	.4	.4	.3	.3	.3	.3	.2	.1
.1	.2	.0	-.3	-.4	-.4	-.4	-.3	-.1	-.2
-.4	-.3	.0	.4	.8	1.2	1.4	1.0	.5	.2
-.1	-.2	-.2	.0	.0	.1	.1	.0	.0	.2
.3	.2	-.1	-.4	-.2	-.2	-.3	-.3	.0	.1
.0	.0	.3	.2	-.1	-.1	.1	.3	.4	.6
.9	.9	.5	-.2	-.3	-.2	.1	.4	.4	.0
-.3	-.3	.0	.4	.6	.3	-.1	-.2	-.1	.0
.2	.3	.4	.5	.4	.0	.0	.1	.2	.3
.4	.5	.4	.2	.2	.0	-.2	-.2	-.1	-.1
-.3	-.5	-.4	.2	.9	1.4	1.6	1.5	1.2	.6
.1	-.2	-.6	-.7	-.7	-.7	-.6	-.5	-.5	-.3
.0	.5	.9	1.1	1.2	.9	.4	.0	.0	.1
.3	.4	.2	-.1	-.4	-.5	-.6	-.7	-.3	.2
.3	.0	-.1	.0	.4	.6	.7	.7	.6	.5
.4	.4	.5	.6	.5	.3	.0	-.2	-.5	-.7
-.9	-1.0	-1.1	-1.2	-1.2	-.9	-.2	.8	1.5	1.8
1.7	1.6	1.4	1.2	1.0	.9	.6	.2	-.3	-.7
-.9	-.8	-.4	-.2	-.2	-.5	-.6	-.6	-.5	-.1
.3	.6	.8	.8	.6	.6	.8	1.0	1.0	.6
.2	-.2	-.4	-.5	-.5	-.4	-.3	-.2	-.2	-.1
.2	.6	.9	1.0	.9	.5	.1	-.1	-.2	-.2
-.2	-.3	-.4	-.5	-.4	-.4	-.4	-.3	-.2	.0
.2	.5	.7	.7	.6	.3	.0	-.2	-.4	-.5
-.5	-.6	-.6	-.7	-.6	-.2	.2	.6	.6	.6
.6	.6	.4	.3	.3	.2	.1	.1	.0	-.3
-.6	-.7	-.7	-.6	-.4	-.3	-.1	.0	.1	.2
.4	.4	.4	.4	.6	.6	.6	.6	.5	.4
.2	.1	.1	.0	-.1	-.2	-.2	-.2	-.2	-.2
-.1	.0	.2	.3	.3	.2	.1	.0	.0	-.1
-.1	.0	.1	.2	.4	.6	.6	.6	.5	.4
.1	.0	.0	.0	-.1	-.1	.0	.1	.3	.5
.6	.7	.6	.4	.2	.1	.0	-.2	-.3	-.3
-.2	.0	.2	.2	.2	.3	.3	.4	.4	.3

TOWER LATINO AMERICANA RECORD OF 19 MAY 1962
N9°E COMPONENT. INSTRUMENT SENSITIVITY 12.5 gals/mm (Continued)

.2	.1	.0	-.1	-.1	.0	.1	.2	.2	.3
.4	.4	.6	.7	.8	.8	.7	.4	.1	-.2
-.4	-.4	-.4	-.4	-.3	-.3	-.1	.2	.3	.6
.7	.7	.5	.4	.2	.0	.0	.0	.0	.0
.1	.1	.2	.4	.6	.7	.7	.7	.6	.4
.3	.1	.0	-.1	-.1	-.1	.0	.0	.0	.0
.1	.0	.0	-.1	-.2	-.3	-.3	-.2	.0	.3
.5	.5	.5	.5	.5	.5	.4	.3	.2	.1
.1	.2	.3	.3	.3	.2	.0	-.2	-.4	-.4
-.4	-.3	-.3	-.3	-.2	.0	.1	.2	.3	.4
.3	.1	.0	-.1	-.1	-.1	.0	.2	.3	.4
.4	.4	.3	.1	.0	-.1	-.2	-.2	-.1	.0
.1	.1	.1	.1	.1	.0	.0	.0	.0	.0
.0	.1	.2	.4	.6	.8	.8	.7	.6	.5
.3	.3	.2	.0	-.1	-.2	-.2	-.2	-.3	-.3
-.3									

TOWER LATINO AMERICANA RECORD OF 19 MAY 1962
N81°W COMPONENT. INSTRUMENT SENSITIVITY 12.5 gals/mm

.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.1	.1	.0	-.1	-.2	-.2	-.1	.0
.0	.0	.1	.1	.1	.0	.0	.0	.0	.0
-.1	-.1	.0	.0	.0	.0	.0	.0	.0	.0
.0	-.1	-.1	-.2	-.4	-.5	-.5	-.4	-.3	-.2
-.1	.2	.4	.5	.5	.6	.4	.3	.1	-.1
-.2	-.1	-.1	-.1	-.1	-.1	.0	-.1	-.2	-.2
-.2	-.1	.0	.0	.0	.0	.0	-.1	-.2	-.4
-.5	-.4	-.4	-.3	-.1	.0	.3	.5	.8	.8
.7	.7	.7	.5	.4	.2	.0	-.2	-.6	-.8
-.7	-.7	-.6	-.6	-.3	.0	.4	.5	.4	.2
.0	-.2	-.2	-.3	-.1	.2	.5	.6	.6	.6
.2	.0	-.2	-.3	.0	.3	.5	.4	.0	-.4
-.5	-.2	.0	.1	-.2	-.7	-.9	-.7	-.2	.1
.1	.1	.1	.2	.8	1.4	1.9	1.9	1.3	.3
-.7	-1.2	-1.2	-.8	-.4	-.3	-.4	-.7	-1.0	-1.0
-.7	-.4	-.2	-.3	-.2	-.1	.1	.7	1.4	1.8
1.6	1.1	.5	.2	.2	.4	.6	.7	.2	-.6
-1.1	-1.2	-1.0	-.6	-.4	-.6	-1.1	-1.4	-1.2	-.7

TOWER LATINO AMERICANA RECORD OF 19 MAY 1962

N81°W COMPONENT. INSTRUMENT SENSITIVITY 12.5 gals/mm (Continued)

.0	.7	1.0	.8	.7	.5	.7	1.1	1.4	1.5
1.2	.8	.1	-.4	-.8	-1.0	-1.0	-.8	-.6	-.5
-.7	-.7	-.4	.1	.6	.9	1.0	.8	.3	-.2
-.2	-.3	-.4	-.4	-.5	-.4	-.2	.2	.7	1.0
1.1	.9	.6	.3	-.1	-.2	-.4	-.5	-.4	-.3
-.2	-.2	-.3	-.3	-.2	.0	.2	.3	.3	.3
.4	.3	.1	.0	-.1	-.2	-.2	-.2	-.2	-.2
-.1	.0	.0	.1	.0	-.1	-.2	-.3	-.4	-.4
-.2	.0	.2	.4	.7	.9	1.2	1.3	1.2	1.0
.5	.0	-.6	-1.1	-1.4	-1.5	-1.4	-1.3	-1.0	-.7
-.3	.0	.4	.7	.9	1.0	.9	.7	.5	.2
.0	.0	.1	.4	.7	.7	.4	.0	-.2	-.1
.1	.1	.0	-.3	-.8	-1.2	-1.4	-1.1	-.6	-.2
-.1	-.2	-.3	-.2	.2	.6	.7	1.0	.9	.8
.7	.5	.3	.0	-.2	-.5	-.9	-1.3	-1.5	-1.6
-1.5	-1.3	-.9	-.5	-.3	.0	.2	.4	.7	.9
.9	.8	.6	.4	.4	.4	.4	.3	.2	-.1
-.5	-.8	-.8	-.8	-.8	-.8	-.9	-.9	-.8	-.6
-.3	.0	.2	.3	.5	.7	.8	.8	.8	.7
.6	.2	-.2	-.4	-.6	-.7	-.8	-.8	-.7	-.5
-.1	.2	.4	.6	.6	.5	.4	.2	.0	-.1
-.1	.0	.1	.1	.1	.1	.2	.2	.2	.2
.0	-.1	-.2	-.2	-.1	.0	.1	.1	.0	-.1
-.1	-.1	.1	.3	.5	.5	.4	.4	.4	.4
.3	.2	.1	-.1	-.3	-.4	-.5	-.5	-.4	-.4
-.3	-.2	-.1	.0	.1	.2	.3	.3	.3	.2
.2	.0	.0	.0	.2	.3	.5	.5	.4	.4
.3	.3	.2	.1	.0	-.2	-.3	-.3	-.2	.0
.1	.1	.0	-.1	-.2	-.2	-.2	-.2	-.2	-.2
-.1	-.1	.0	.1	.2	.4	.6	.8	1.0	1.0
.9	.7	.4	.3	.1	.0	-.2	-.2	-.3	-.4
-.5	-.5	-.5	-.4	-.4	-.3	-.2	-.1	-.1	.1
.2	.3	.3	.3	.2	.2	.2	.3	.3	.3
.2	.2	.2	.1	.0	.0	-.2	-.3	-.4	-.5
-.6	-.6	-.6	-.6	-.6	-.5	-.3	-.2	.0	.2
.4	.5	.5	.5	.4	.3	.2	.2	.1	.0
.0	.0	.0	.0	-.1	-.3	-.5	-.6	-.6	-.6
-.5	-.4	-.3	-.1	.0	.1	.2	.2	.2	.3
.3	.3	.2	.2	.2	.1	.1	.1	.1	.2
.2	.2	.2	.1	.1	.0	.0	.0	.0	.0
.0									

ALAMEDA PARK RECORD OF 11 MAY 1962

N10°46'W COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm

.0	1.0	.9	.7	.1	-.4	-.2	-.1	.2	.8
1.0	.8	.8	1.0	1.2	1.2	.9	.8	.4	.3
.3	.4	.9	1.0	.6	.0	-.2	.0	.9	1.4
1.3	1.1	1.0	1.0	.8	-.1	-.7	.1	1.0	1.0
.2	-.2	.0	-.4	-.8	-.2	.7	1.5	2.2	2.3
2.0	1.0	.7	.8	1.0	1.4	1.9	2.1	2.0	1.0
-1.0	-2.2	-2.7	-1.8	-.4	1.1	1.8	1.2	.3	-.2
-.1	-.2	-.8	-.1	1.3	1.1	.8	-.3	.0	1.8
2.0	.7	.0	.3	.8	1.0	1.2	1.9	1.2	.0
-1.5	-2.0	-1.9	-.7	-1.1	2.0	1.7	-.7	-2.8	-2.9
-1.1	.6	.9	1.0	.9	.7	.9	1.0	1.2	2.3
3.3	3.9	2.5	.1	-1.0	-1.9	-2.0	-2.0	-2.0	-1.8
-1.5	-1.4	-1.0	.0	.1	.0	.0	.0	.8	1.8
1.9	1.8	2.0	2.1	1.0	-.3	-.7	.0	.8	1.0
.1	-.2	.0	-.1	-.9	-1.0	-1.0	-.9	-.3	-.2
-.3	-.1	.5	.5	.1	.1	1.5	2.2	2.7	1.9
.9	.0	-.7	-.8	-.6	-.1	.0	.2	.9	.9
.3	.6	.8	.2	-.8	-1.1	-1.3	-1.6	-.9	-.4
-.1	.1	.9	1.2	1.8	1.9	1.8	1.1	1.0	1.0
1.0	.9	.0	-1.1	-1.3	-1.3	-1.3	-1.1	-.3	-.3
-.2	.4	.9	.9	1.2	2.2	2.4	1.0	-.9	-1.7
-1.8	-1.5	-1.6	-.8	.0	.3	.4	.3	.2	.8
1.9	2.0	1.7	1.2	1.1	1.0	.8	.0	-.8	-1.0
-1.1	-1.1	-1.2	-1.1	-.2	.2	.3	.0	-.2	.2
1.0	1.8	2.1	2.4	2.8	2.8	1.9	1.0	.7	.9
1.0	.4	-.7	-1.2	-1.8	-1.9	-1.8	-1.4	-1.2	-1.1
-1.1	-.7	.7	1.5	2.0	2.1	2.5	2.9	2.7	2.0
1.7	1.8	1.9	1.4	.7	-.2	-.9	-1.8	-1.9	-1.8
-1.7	-1.2	-.9	-.4	.0	.2	.9	1.3	2.0	2.2
2.2	1.8	1.2	1.4	1.8	1.6	1.1	.4	.0	-.2
.0	.7	.9	1.0	.8	-.2	-.8	-.9	-.7	-.7
-.2	.0	.3	.7	1.1	1.4	1.9	2.1	2.6	2.2
1.5	.8	-.5	-1.0	-1.1	-1.0	-.1	.9	1.3	1.0
.2	-.6	-1.0	-1.0	-.8	.0	.6	1.0	1.1	1.2
1.7	1.7	1.3	1.2	1.1	.9	.1	-.5	-.9	-.9
-.5	-.6	-.7	-.3	.1	.2	.1	.0	.0	.0
.7	1.1	1.8	2.2	2.1	2.0	1.8	.9	.0	-.6
-.7	-.8	-.8	-.9	-.7	-.5	-.5	-.2	.1	.2
.2	.1	.0	.1	.0	.0	.8	1.4	1.8	1.8
1.8	1.2	.8	.4	.2	-.1	-.3	-.5	-.6	-.4
-.4	-.5	-.8	-.8	-.4	.0	.1	.5	.9	1.2
1.4	1.4	1.4	1.2	.9	.7	.4	.5	.6	.7
.8	.8	.7	.5	.2	.0	-.6	-.8	-1.0	-1.0
-1.0	-.5	.1	.4	.6	.8	.9	.9	1.0	1.0
1.0	1.2	1.4	1.5	1.3	1.1	1.0	.8	.3	-.2

ALAMEDA PARK RECORD OF 11 MAY 1962

N10°46'W COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm (Continued)

-.6	-.8	-.6	-.2	.0	.4	.3	.2	.0	.0
.1	.8	.8	.7	.3	.1	.0	.2	.8	.9
1.0	1.1	1.0	.8	.1	-.2	-.5	-.8	-.9	-.9
-.6	-.4	.0	.2	.3	.6	.8	.9	.9	.9
.8	.8	.7	.4	.3	.3	.3	.2	.1	.0
-.1	-.4	-.7	-.6	-.3	.0	.1	.3	.4	.2
.1	.2	.7	.9	.9	.8	.7	.2	.1	.1
.1	.2	.2	.2	.2	.2	.3	.6	.9	.7
.5	.2	.1	-.1	.0	.1	.4	.7	.7	.7
.8	.8	.9	1.0	.8	.4	.1	.1	.1	.3
.5	.8	.9	.8	.7	.4	.3	.3	.7	.6
.6	.4	.2	.0	-.1	-.1	-.1	.2	.8	.9
.9	.9	.8	.6	.3	.2	.7	.8	.7	.4
.4	.3	.2	.2	.3	.3	.6	.6	.3	.2
.2	.2	.1	.1	.0	.0	.0	.2	.4	.8
1.0									

ALAMEDA PARK RECORD OF 11 MAY 1962

N79°14'E COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm

.0	-.4	-.2	.0	.2	.0	.0	-.2	-.8	-.9
-.3	-.1	-.6	-1.0	-1.1	-.9	-.2	.3	.8	1.0
.2	-.8	-.6	.0	.2	.7	.4	.0	-.2	-.6
.0	.9	.8	.0	-1.0	-1.2	-.9	-.6	-.7	-.4
-.3	-.6	-.3	.1	.4	.4	.2	.7	.8	.2
-.7	-.9	-.1	.5	.0	-.4	-.8	-1.1	-1.2	-1.0
.0	.0	.3	.2	.1	-.2	-1.1	-1.1	-.8	.0
.0	.0	.2	-.2	-1.2	-1.3	-.1	-.1	-.9	-1.0
-.4	.0	.3	-.1	-1.2	-.6	.0	.0	.0	.2
-.1	.0	-.5	-1.8	-1.7	-.9	-.2	-.2	-.8	-.2
.7	1.0	1.0	.7	.3	.7	.3	-.3	-.9	-1.3
-2.0	-2.1	-1.7	-1.0	-.9	-.8	-.1	.2	.5	.1
.0	.0	.1	.1	.0	-.5	-.8	-1.0	-.4	-.1
-.4	-.7	-.5	-.1	.0	.1	-.1	-.8	-.4	-.1
.0	.2	.3	.4	1.0	.9	-.1	-2.0	-2.7	-2.2
-1.7	-.8	-.1	.0	-.7	-.6	-.2	.1	.4	.2
.9	1.8	1.1	.0	-.2	.0	.3	.9	.1	-1.1
-1.9	-1.9	-1.9	-1.2	-.4	-.1	-.9	-1.3	-1.6	-1.1
-.7	-.2	-.1	-.1	-.1	.0	1.8	2.8	3.0	2.1
1.0	.8	.3	-1.0	-2.0	-2.0	-2.0	-2.8	-3.2	-3.1

ALAMEDA PARK RECORD OF 11 MAY 1962

N79^{o}14'E COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm (Continued)

-2.8	-1.7	-.1	.3	.0	-.3	.1	1.8	2.3	2.2
2.0	1.3	.9	.9	.0	-1.0	-1.7	-1.6	-1.6	-1.3
-1.0	-.9	-.8	-1.3	-1.9	-2.0	-1.7	-1.0	-.2	.1
.3	.2	.0	.0	.8	1.1	1.0	.9	.8	.8
.6	.3	-.3	-1.3	-1.9	-2.0	-2.1	-2.0	-2.0	-2.0
-1.3	-.6	-.2	-.1	.1	1.0	1.3	1.2	.9	.8
.8	.8	.1	-.6	-.4	-.4	-.8	-.9	-1.0	-1.0
-1.6	-1.9	-1.9	-1.7	-1.1	-.6	-.3	.0	.7	.7
.4	.5	.8	.9	.9	.9	.9	.7	.1	-.3
-.5	-.7	-1.0	-1.8	-1.9	-1.8	-1.7	-1.9	-1.8	-1.8
-1.7	-1.1	-.2	.7	1.0	1.1	1.3	1.8	1.8	1.3
1.0	.2	-.6	-1.2	-1.8	-2.0	-2.0	-1.8	-1.3	-1.1
-.8	-.3	-.1	.0	.0	.0	.0	.0	.1	.2
.4	.3	.2	.0	-.7	-.8	-.5	-.2	.1	.1
-.2	-.8	-1.0	-.9	-.8	-.3	-.2	-.1	-.6	-.9
-.9	-.4	.1	.3	.4	.6	.7	.2	.0	.0
.0	-.3	-1.0	-1.2	-1.3	-1.3	-1.1	-1.0	-1.0	-1.0
-.9	-.2	.3	.5	.6	.7	.8	.6	.2	-.1
-.3	-.5	-.8	-.9	-.8	-.4	-.1	.0	.1	.1
.2	.2	-.1	-.4	-.8	-1.1	-1.2	-1.2	-1.0	-1.0
-.9	-.6	-.1	.1	.8	1.0	1.0	.8	.3	.2
.1	.0	.0	-.2	-.7	-1.0	-1.2	-1.4	-1.2	-1.0
-.9	-.9	-.9	-.9	-.8	-.2	.1	.2	.2	.3
.4	.6	.6	.7	.3	.0	-.2	-.3	-.1	.0
.0	-.1	-.7	-.9	-1.0	-1.0	-1.0	-.9	-.9	-.8
-.7	-.7	-.4	.0	.0	.0	.0	.0	.0	-.1
-.2	-.2	-.3	-.3	-.1	.0	.1	.0	.1	-.4
-.9	-.9	-.8	-.9	-1.0	-1.0	-1.0	-.9	-.6	-.2
.0	.0	.0	-.1	.0	.1	.1	.4	.8	.5
.1	-.4	-.8	-1.0	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
-1.0	-.6	-.3	-.1	.0	.6	.6	.2	-.1	-.3
-.3	-.3	-.3	-.3	-.2	.0	.0	-.2	-.3	-.8
-.9	-1.0	-1.2	-1.1	-1.0	-.9	-.8	-.7	-.6	-.6
-.4	-.1	.0	.0	.1	.2	.3	.2	.0	.0
-.1	-.2	-.3	-.4	-.4	-.3	-.7	-.7	-.6	-.4
-.4	-.4	-.3	-.1	.0	-.1	-.2	-.4	-.4	-.4
-.3	-.1	.0	.0	-.1	-.3	-.7	-.8	-.7	-.6
-.3	-.1	.0	-.1	-.1	-.1	-.1	.0	.0	.0
.0	-.2	-.3	-.5	-.4	-.2	-.2	-.1	-.1	-.1
-.3	-.6	-.8	-.8	-.6	-.6	-.7	-.4	-.2	-.1
.0									

ALAMEDA PARK RECORD OF 19 MAY 1962

N10°46'W COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm

.0	-.2	-.3	-.6	-.7	-.3	.0	.0	.1	.4
.4	.5	.4	.2	-.4	-.7	-.3	.0	.5	.4
.0	-.2	-.7	-1.0	-.9	-.2	.2	.3	.0	-.3
-.1	.1	.2	.8	.6	.1	-.1	-.5	-.9	-.7
-.3	.0	.0	-.2	-.3	-.4	-.3	-.2	.1	.7
.8	.7	.1	-.1	-.7	-.8	-.7	-.1	.0	-.2
-.6	-.9	-.9	-.8	-.4	-.1	.1	.8	.8	.5
.1	.0	.0	-.2	-.6	-1.0	-1.0	-1.0	-.9	-.8
-.6	-.6	-.3	.0	.0	.0	-.1	.0	.5	.7
.5	.3	.8	1.1	1.2	.2	-.7	-1.0	-.9	-.8
-.1	-.1	-.8	-.9	-.9	-1.2	-1.3	-1.0	-.7	-.2
-.9	-1.0	-.8	-.1	.3	.9	1.5	1.4	.9	.1
-.7	-.9	-.3	.4	.8	.9	.8	-.3	-1.0	-1.1
-1.0	-1.0	-1.0	-1.1	-1.5	-1.8	-1.8	-1.3	.3	2.0
2.2	1.5	.7	-.3	-1.6	-1.9	-1.1	.7	2.2	3.0
1.3	-.7	-1.0	-1.0	-1.0	.1	.9	.4	-1.0	-1.8
-2.0	-1.9	-1.0	-.5	.0	.2	.0	-.6	-.7	.0
.6	.9	1.0	1.1	1.3	1.5	1.4	.7	-.8	-1.1
-1.0	-1.1	-1.8	-1.8	-1.3	-.7	-.7	-1.1	-1.8	-1.6
-1.0	-.2	.9	1.9	3.0	3.0	2.3	1.2	.5	.0
-.7	-1.0	-1.1	-.6	-.6	-.6	-1.0	-1.9	-2.0	-1.9
-1.1	-.5	.2	.7	.8	.6	.1	.2	.4	.2
.0	.0	.1	.0	-.4	-.1	.0	.1	.0	-.6
-.7	-.1	.2	.3	.1	.0	.0	.0	-.2	-.8
-.9	-.4	-.4	-1.0	-.9	-.4	.1	-.2	-1.0	-1.0
-1.0	-1.0	-.9	-.2	.7	1.2	1.6	1.1	1.0	.8
.2	-.3	-.7	-.3	-.2	-.6	-1.1	-1.5	-1.5	-1.0
-.9	-.8	.1	.8	.7	.3	.0	-.2	-.1	.2
.7	1.1	1.5	1.7	1.0	-.1	-.9	-1.0	-.8	.0
-.2	-.9	-1.3	-1.5	-1.4	-1.0	-.5	.1	1.0	1.3
1.3	1.2	1.5	1.8	1.9	1.6	1.0	.7	.0	-.3
-.5	-.8	-1.3	-1.8	-2.1	-2.0	-1.6	-1.0	-.3	.0
.3	.8	1.3	1.8	2.2	2.2	2.0	1.4	.9	.3
-.3	-.8	-.8	-1.0	-.8	-.7	-.3	-.1	.2	.3
.4	.4	.3	-.1	-.3	-.5	-.4	.0	.8	1.0
1.2	1.0	.7	.2	.0	.0	.3	.3	.0	-.4
-.4	.0	.1	.1	.3	.3	.3	-.8	-.8	-.3
.0	.1	.1	.3	.7	1.1	1.3	1.5	1.4	1.0
.6	-.1	-.8	-1.3	-2.0	-2.2	-2.4	-2.0	-1.0	-.1
.5	.7	.5	.3	.4	.7	.9	1.3	1.8	1.6
1.0	.2	.0	.0	-.1	-.9	-1.2	-1.6	-1.4	-1.0
-.8	-.3	.1	.1	.0	.0	.0	.0	.0	.1
.2	.3	.3	.2	.0	-.1	-.3	-.4	-.6	-.6
-.7	-.7	-.7	-.6	-.4	-.2	-.1	.0	.2	.4
.5	.5	.3	.0	-.2	-.7	-1.0	-1.0	-1.0	-1.0

ALAMEDA PARK RECORD OF 19 MAY 1962
N10°46'W COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm (Continued)

-.9	-1.1	-.9	-.9	-.6	-.1	.0	.1	.0	.0
-.1	-.1	-.1	-.1	-.5	-.9	-.9	-.8	-.6	-.4
-.4	-.3	-.2	-.1	-.2	.0	.0	.0	.0	.0
-.3	-.6	-.4	-.1	-.1	-.1	-.5	-.8	-.9	-1.0
-.7	-.6	-.1	.0	.0	.0	.0	-.2	-.1	-.1
.0	.0	-.1	-.1	-.1	.0	.0	.1	.1	.1
.0	.0	.1	.3	.8	.9	.7	.1	-.1	-.4
-.6	-.9	-1.1	-1.0	-1.2	-1.2	-1.2	-1.1	-1.0	-.7
-.5	-.3	-.3	-.1	.0	.0	.1	.3	.6	.7
.5	.4	.2	-.1	-.7	-1.0	-1.2	-1.7	-1.7	-1.5
-1.2	-1.0	-.9	-.6	-.4	-.3	-.3	-.3	-.2	.0
.1	.3	.4	.5	.3	.2	.0	-.1	-.3	-.6
-.9	-1.1	-1.2	-1.5	-1.7	-1.7	-1.7	-1.6	-1.3	-1.1
-.8	-.3	.1	.3	.7	.7	.7	.7	.8	.6
.1	-.2	-.5	-.6	-.7	-.6	-.4	-.3	-.6	-.6
-.6									

ALAMEDA PARK RECORD OF 19 MAY 1962
N79°14'E COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm

.0	-.1	-.1	.0	.1	.3	.2	.0	-.1	-.4
-.1	.0	.0	.0	.1	.2	.4	.1	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
.3	.1	.0	.0	.0	.3	.4	.9	1.0	.9
.0	-.6	-.8	-.9	-.8	-.5	-.5	-.5	-.6	-.4
-.5	-.2	.1	.1	-.1	-.3	-.1	.2	.8	.9
.9	.9	.8	.0	-.1	-.2	-.3	-.2	-.2	-.1
.0	.0	.0	.2	.0	-.1	-.8	-1.0	-1.1	-1.1
-1.1	-.3	.1	.1	-.1	-.1	-.1	-.8	-.9	-.2
1.0	1.0	.8	.3	.0	-.7	-1.0	-1.0	-.1	.1
.0	.0	.0	-.2	-.8	-1.0	-1.0	-1.0	-.8	-.1
.7	1.2	1.2	.7	-.4	-1.4	-1.4	-.2	.2	.2
.4	.4	-.1	-.4	.0	.2	.5	.4	-.2	-.8
-.8	-.3	1.0	1.3	.3	-1.1	-1.9	-1.8	-1.1	-.9
-.4	.4	.4	.0	.0	.2	1.0	.9	.2	.2
.8	.9	.9	.9	.8	.1	-.8	-1.7	-1.9	-1.5
-1.0	-.9	-.9	-1.0	-1.0	-1.1	-.8	.2	1.2	1.8
1.3	1.0	1.0	1.6	2.1	2.2	1.7	.0	-1.0	-1.8
-1.9	-1.6	-1.0	-.5	-.7	-1.0	-1.2	-1.3	-1.0	-.7
-.1	.7	1.0	1.0	1.4	2.0	2.0	1.9	1.2	.1

ALAMEDA PARK RECORD OF 19 MAY 1962

N79°14'E COMPONENT. INSTRUMENT SENSITIVITY 25 gals/mm (Continued)

-.9	-1.2	-1.1	-.2	.0	-.5	-.5	-.5	-.5	-.8
-.9	-.7	-.2	-.2	-.4	-.3	-.1	.0	-.2	-.3
.2	1.0	1.2	1.2	1.1	.9	.1	-.1	-.7	-.8
-.6	-.6	-.9	-1.1	-1.2	-1.1	-1.1	-1.0	-.3	.0
.4	.8	.9	1.0	1.2	1.1	1.0	.9	.8	.6
-.1	-.9	-.6	-.1	-.1	-.1	-.1	-.1	-.1	-.8
-1.3	-1.4	-1.3	-1.3	-1.7	-1.2	-.8	.0	.6	.8
.9	1.0	1.1	1.8	2.0	2.0	1.8	1.1	.1	-1.1
-2.1	-2.7	-2.4	-2.0	-1.9	-1.7	-1.7	-1.4	-.8	-.2
.2	.8	1.2	1.9	1.7	1.1	1.0	1.2	1.1	.9
.0	-.9	-1.6	-2.0	-1.9	-1.2	-.8	-.7	-.3	-.1
.0	.1	.3	1.0	1.3	1.3	.9	.3	.3	.2
.0	-.3	-.6	-.7	-.4	-.1	.1	.2	.1	-.4
-1.0	-1.0	-1.0	-.6	-.1	.0	-.1	-.3	-.2	.2
.6	.8	.7	.3	.0	-.2	-.4	-.2	.0	.2
.0	-.7	-.9	-.8	-.7	-.2	-.1	.0	.1	.2
.3	.3	.1	.1	.3	.2	.0	-.2	-.8	-.9
-.8	-.7	-.5	-.4	-.3	-.2	-.1	.0	-.2	-.6
-.4	-.1	.0	.2	.3	.1	.0	-.1	-.1	-.1
-.1	-.1	-.1	-.1	-.1	.0	.0	.0	-.2	-.3
-.4	-.4	-.4	-.4	-.5	-.6	-.5	-.3	-.2	-.2
.0	.0	.2	.2	.0	-.1	-.4	-.7	-.9	-.8
-.2	.0	.3	.3	.1	.0	-.2	-.6	-.8	-.7
-.3	-.2	-.2	-.2	.0	.3	.4	.3	.2	.1
.0	-.8	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.0	-.7
-.1	.0	.1	.2	.2	.1	.0	.0	.0	.0
.0	.0	.0	-.1	-.1	-.2	-.2	-.2	-.3	-.3
-.3	-.4	-.8	-.9	-.9	-.9	-1.0	-1.1	-1.1	-1.1
-1.0	-.8	-.4	-.1	.1	.2	.2	.2	.2	.2
.1	.0	-.2	-.2	-.2	-.1	-.1	-.2	-.3	-.7
-.9	-1.0	-1.0	-1.0	-.9	-.8	-.7	-.6	-.4	-.3
-.2	-.1	-.1	-.2	-.3	-.2	.0	.0	.1	.2
.1	.0	-.2	-.6	-.8	-.9	-.9	-.8	-.7	-.7
-.9	-1.1	-1.1	-1.0	-.9	-.3	-.2	-.2	-.2	-.2
-.3	-.4	-.4	-.4	-.2	-.1	-.1	.0	.0	.0
.0	.0	.0	-.1	-.1	-.2	-.6	-.9	-1.1	-1.2
-1.2	-1.2	-1.2	-1.3	-1.1	-1.0	-.9	-.4	-.1	.1
.3	.3	.2	.1	.0	.0	.0	-.1	-.2	-.4
-.7	-.8	-.8	-.8	-.8	-.8	-.8	-.9	-.7	-.4
-.4	-.4	-.4	-.4	-.4	-.4	-.2	-.1	.0	.0
.0									